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INDEX TO VOLUME VII.

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EXPLANATORY NOTE.—Items in italics are names of books reviewed; illustrated articles are denoted by Asterisks (*), the letters (c.l.) refer to notices of articles under the heading 'Current Literature'; the letters (p.t.) to abstracts appearing in 'Précis of Technology.'

	PAGE		PAGE
Abosso Gold Report	75, 386	Bronze, Ancient (p.t.)	458
Accounts, Gold Mine G. W. Tait	307	Brough Medal	*406
Africa, In South Central J. M. Moubay	420	Brown, Alexander O. Murchison Range	*279
Air-Blasts on Rand	322	Brown, W. L. Steel Sets in West Africa (p.t.)	*300
Aladdin Cobalt Co.	322	Bryant, J. W. Rainy Hollow Copper District	*448
Alaska Mexican Report	*77	Bubola Process	264
Alaska Perseverance	*185	Burma Mines Report	*230
Alaska Treadwell Report	*76	Burma Ruby Mines Report	*230
Alaska United Report	*76	Burnham M. H. Modern Mine Valuation	383, 441
Allen, A. W. Concentration & Cyanidation	43	Butte Geology W. H. Weed	461
	61	Butters and Moore Litigation	323
	294		
Alluvial Deposits, Stripping (c.l.)	228	Calabashing Report	*23
Alumina in Copper Slags H. C. Bellinger (p.t.)	143	Cam and Motor Report	*469
Aluminium in America	62	Cam and Motor Pearse, Kingston, and Browne	440
Aluminium, Metallurgy of (p.t.)	304	Cam and Motor, Metallurgy at	318
Amalgamated Zinc (De Bavay's) Report	389	Camborne Letter *38, *113, *191, *270, *342, *430	
American Election	325	Camborne Mining School	11
American Mining Engineer, An Mexican Situation	*294	Camp Bird Report	465
Ammonium Sulphate, Direct Production of (p.t.)	146	Canp Bird Group	407
Anaconda Copper Report	77	Canadian Mining and Exploration Co.	164
Anantapur Goldfield Report	*78	Cananea, Screen Analysis at (c.l.)	382
Anantapur, North Report	313	Carn Brea and Tincoft Report	*235
Anglo-Continental in Nigeria	329	Carter, T. Lane, Death of	245
Anonymous Communications	404	Carter, T. Lane Dry Placers in Arizona (c.l.)	228
Antelope Report	*156		The Engineer in the Tropics
Antimonial Tailing, Cyaniding	69		*129
Aporoma Report	311	Caucasus Copper	*385
Aramayo Francke Mines Report	466	Cemented Ore Ernest Williams	437
Arizona Copper Report	233	Centenillo Lead Mine	401
Arkansas, Diamonds in	454	Central Chile Copper Report	*233
Arizona, Dry Placers in T. Lane Carter (c.l.)	228	Central Zinc Report	*230
Arsenate in Cyanidation, Effect of A. F. Crosse (p.t.)	146	Chamber of Mines, London and West Country	114
Asgard Report	467	Charleton, A. G. Mining Schools	217
Ashtani Rivers and Concessions	392	Chilean Mills, Low-Speed (p.t.)	457
Asbio Mine, Japan (c.l.)	305	Chillagoe Report	*389
Associated Gold Mines of Western Australia	154	China Clay Corporation	308
Atbasar Developments	165	China, Mining in	95
Auckland Letter	118	Chota Nagpur	404
		Christmas Suggestion	405
Banks, C. A. A Tailing Plant	*121	Christmas Suggestion H. G. Payne	441
Barrania Mining and Exploration Report	*309	Chiquicamata Mine	401
Base-Metal Mines, Valuation of W. H. Goodchild	50	Churn-Drill in Shaft-Sinking (p.t.)	146
Basset Mines	430	Classifier, Skinner's Hydraulic (p.t.)	*63
Bechuanaaland Copper Report	310	Clay-Workers' Handbook A. B. Searle	228
Bell Reef Report	310	Clays, Shales, and Sands, British A. B. Searle	229
Bellinger, H. C. Alumina in Copper Slags (p.t.)	143	Clerc, F. L. Zinc Metallurgy (p.t.)	*223
Bendigo, Mining at M. W. von Bernewitz	*135	Coal by X-Rays, Examining (p.t.)	66
Benoni Plant Failure	107	Coal-Dust Explosions, Preventing, W. E. Garforth (p.t.)	65
Binti-Binti, W. A.	339	Coalging Oilfield T. A. Rickard	*283
Blackwater Report	74	Cobalt	172
Blast-Furnaces, Drying Air for (c.l.)	228	Cobalt R. E. Hore (c.l.)	228
Blasting-Fumes, Preventing (p.t.)	302	Cobalt C. A. O'Connell	*442
Bleischarley, Concentration at (c.l.)	460	Coke, Absorption of Water by (p.t.)	226
Bolivia, Tin-Silver Ores in G. E. Brown (c.l.)	70	Colledge, A. Loose Nomenclature	439
Brakpan Properties	396	Colombia, Gold in (c.l.)	305
British Columbia, Production	100	Colombia, Mining Laws of P. J. Eder	229
British Columbia, Silver-Lead Deposits of (p.t.)	143	Concentration & Cyanidation A. W. Allen	43
British Columbian Minerals E. Jacobs	119	Concentrator for Slime, Wilfley's (p.t.)	*457
Broken Hill Block 10 Report	154	Concrete Mine-Supports C. A. O'Connell	*457
Broken Hill Block 14 Report	154	Concrete for Roofing a Level W. F. Wilkinson	*450
Broken Hill, British Report	464	Concrete Shafts (p.t.)	456
Broken Hill, New Plant at (p.t.)	63	Consolidated Gold Fields	412
Broken Hill, North Report	310	Consolidated Gold Fields of New Zealand Report	74
Broken Hill, North, Reorganization of Capital	350	Consolidated Langlaagte Report	*71
Broken Hill Proprietary Report	*464	Consolidated Main Reef	391
Broken Hill Proprietary's Iron Mine	84, 115	Consolidated Oil Fields	405, 410
Broken Hill South Report	310	Converter at Great Falls	288
		Converters, Development of	124

THE MINING MAGAZINE

	PAGE		PAGE
Coodardy Tin	338	Giant Mines of Rhodesia	Report
Copper, <i>Hydrometallurgy of</i>	W. E. Greenwalt	Gitsham Gold-Extracting Process	(c.l.)
Copper Production in America	(p.t.)	Globe and Phoenix	Report
Copper Smelting, Modern	D. A. Levy	Glynn's Lydenburg	Report
Copper, Standard	E. A. Lewis (c.l.)	Gold, Future Output of	H. C. Hoover (p.t.)
Cornish Methods	T. H. Prisk	Gold in Nitric Acid, Solubility of	(p.t.)
Cornwall, An Excursion in	E. Rickard	Goodchild, W. H.	Phantom Profits
Cochabato District, Bolivia	L. W. Strauss		Valuation of Base-Metal Mines
Crozier's Aluminum Process	(c.l.)	Gopeng Tin	Report
Craig, E. H. Cunningham	Oil-Finding	Goss Moor	J. E. Macnamara and H. E. Fern
Crane, W. R., <i>Index of Mining Engineering Literature</i>	384	Goss Moor Tin Alluvials	Report
Criticism	411	Goss Moor Tin Alluvials	Report
Crosse, A. F., Effects of Arsenates in Cyanidation (p.t.)	146	Govett, F. A., and Lake View and Oroya Exploration	326
Cyanide Plant, Iron in	(c.l.)	Grenville Mining	Prospectus
Cyanide Process, Parks	(c.l.)	Graphite Mining	(c.l.)
Cyanide Treatment, Lead Salts in	(c.l.)	Great Boulder Proprietary	Report
		Great Boulder Proprietary	Report
De Bavy's Process	(p.t.)	Great Fingall Consolidated	Report
De Lamar	Report	Great Victoria, Southern Cross	264
Debentures in Mining	256	Greenawalt W. E.	<i>Hydrometallurgy of Copper</i>
Debentures in Mining	Morton Webber	Greenbushes Tin District	399
Deep Mining on Rand	346	Gregory, J. W.	<i>Making of the Earth</i>
Definitions	22	Grenfell Group	306
Denny, H. S.	Phantom Profits	Grenville Mine	Report
Diamond Mine, Premier	Ralph Stokes	Grenville United	Report
Diamonds, Derdepoort	(p.t.)	Gunter, C. G.	<i>Examination of Prospects</i>
Diamonds, Genesis of	O. O. Derby (p.t.)	Gwalia Consolidated	Report
Diamonds in Arkansas	454	Gwalia Consols, New Process	399
Directors as Trustees	14	Gwithian Sands	*342
Directors' Fees	89		
Dolcoath	Report	Hainault	Report
Dolcoath Mine	*334	Harvey, Frank	Hemp Ropes
Drag-Classifier, Esperanza	(p.t.)	Hendryx Agitator	(p.t.)
Drake, Francis	Institutes as Publishers	Hershey, O. H.	Genesis of Warnder Deposits (c.l.)
Dredging in Frozen Ground	*176, *332	Herzig, C. S.	Mining Law in Nigeria
Dry-Concentration of Placer Gold, F. J. H. Merrill (p.t.)	148	High-Grade, California	(p.t.)
Drying Ores, Losses in	(p.t.)	Holman Air-Cushion Stamps	168
Dunderland Iron Co. Bankrupt	166	Holman Air-Cushion Stamp in Australia	(p.t.)
Dust, Electric Precipitation of	(c.l.)	Homesdale, E.	Engineer in the Tropics
Dust-Explosions	52	Honestake Metallurgy	Clark and Sharwood (c.l.)
Dust-Prevention	(c.l.)	Hommel, W.	Blende Roasting (c.l.)
		Hoover, H. C.	Future Output of Gold (p.t.)
<i>Earth, Making of the</i>	J. W. Gregory		Mine Valuation and Mine Finance
East Pool and Agar	322, 342	Hoover, T. J.	<i>Concentrating Ores by Flotation</i>
East Rand Gold, Coal, and Estate	Report		Processes and Publicity
East Rand Mining Estates	Report	Horwood, C. B.	Iridosmine in Rand Banket (p.t.)
Editors, Geology of	(p.t.)	Hoskin, A. J.	<i>The Business of Mining</i>
Editors and Secretaries	415	Humboldt Furnace for Roasting Tin Ores	271
Efficiency	178	Huti (Nizam's) Gold Mines	Report
Efficiency	A. C. Schonberg	Hyde's Flotation Process	(p.t.)
El Oro Mining and Railway	*312		
Eldorado	Report	Illiterate Technology	180
Eldorado Banket	93	<i>Index of Mining Engineering Literature</i>	W. R. Crane
Electric Furnace for Precipitate and Concentrate	(c.l.)	Indian Mines	(p.t.)
Elmore Volume on Geology of Ore Deposits	248	Indian Minerals	223
Esperanza Drag-Classifier	(p.t.)	Inexperience, Dangers of	177
Explosives, High	W. R. Quinan	Institutes and Institutions	94
Extraction Problems	251	Institutes as Publishers	95
		Institutes as Publishers	Francis Drake
Falcon Mines	Report	Iridosmine in Rand Banket	C. B. Horwood (p.t.)
Falconer, J. D.	Nigerian Tin (p.t.)	Iron and Steel in Australia	424
Falmouth Consolidated	Report	Iron and Steel Production, World's	(p.t.)
Fawns, S.	<i>Tin Deposits of World</i>		
Feldtmann, W. R.	Phantom Profits	Jacobs, E.	British Columbian Minerals
Fern, H. E., and J. E. Macnamara	Goss Moor	Japan, Zinc in	(c.l.)
Ferro-Concrete Shaft-Linings	(p.t.)	Jibuti Mines of Anantapur	Report
Ferro-Silicon	(c.l.)	Johannesburg Letter	*27, 106, *186, *261, *346
Fink Furnace	405	Johnson, Howard	Costs in Nigeria
Fink Furnace	(p.t.)	Jumbo	Report
Flies, Campaign Against	(c.l.)	Jumpers Mine	*421
Flotation at Kyle Mine	328		
Flotation, Concentrating Ores by	T. J. Hoover	Kalgoorlie, Discovery of Tellurides at	J. M. MacLaren
Flotation Process, Hyde's	(p.t.)	Kalgoorlie, Early Days at	H. E. West
Flotation Processes	K. A. Mickle (p.t.)	Kalgoorlie Letter	40, 112, 182, 265, 338, 425
Flotation Processes	L. Herwegen (c.l.)	Kalgoorlie, Tellurides at	(p.t.)
Fluor-Spar in England	378	Keating, J. E.	Prospecting for Tin in Nigeria
Flues, Campaign Against	328	Kenecott Copper Mines	(p.t.)
Flotation at Kyle Mine	328	Kent Coalfield	(p.t.)
Frank, W. R. T.	Randfontein Central	Keogh, Sir A.	Engineer in the Tropics
Freeport Sulphur Co.	(c.l.)	Klerksdorp District	421
Freeport Sulphur Co.	(c.l.)	King, E. S.	Unreliability of Ore-Tests
French's Zinc Process	223	Kingsdown Tin	Prospectus
Frontenac, Sir J. French visits	324	Kinta Tin	Report
Frozen Gravel, Stripping	413	Komata Reefs	Report
Frozen Ground, Dredging in	*332	Korea, Mining in	(p.t.)
Frozen Ground, Mining in	*176	Kotze, R. N.	Subsidence-Shocks on the Rand (p.t.)
Fume-Filters	Anton Eilers (p.t.)	Kurnalpi, Discovery of Gold at	182
		Kyloe Mine, Flotation at	328
Gaika	Report	Kyshtim Corporation	Report
Garforth's Method of Preventing Coal-Dust Explosions (p.t.)	65	Kyshtim, Developments at	320
Geover Tin Mines	Report	Kyshtim Smelter	E. J. Carlyle (c.l.)
Geology, <i>Practical Field</i> , J. H. Farrel and A. J. Moser	306		
Geology, <i>South African</i>	E. H. I. Schwartz		
Geology, <i>Structural and Field</i>	J. Geikie	La Rose Consolidated	Report

THE MINING MAGAZINE

	PAGE		PAGE
<i>Rand Metallurgical Practice, Vol. II</i>	228	Taqua Mining and Exploration.....	Report 75, 383
Rand Mines, Lives of.....	(p.t.) 377	Tasmanian Copper.....	Report 463
Rand Problems.....	248	Tellurides at Kalgoorlie.....	(p.t.) 457
Rand Problems.....	Africanus 353	Tellurides at Kalgoorlie, Discovery of, J. M. MacLaren.....	41
Rand Reserves.....	402	Temperatures at St. John del Rey.....	(p.t.) *66
Rand, Subsidence-Shocks on the.....	R. N. Kotze (p.t.) 147	Thistle-Etna.....	Report 310
Randfontein Central.....	W. R. T. Frank 141	Ticketing, Cornish Tin.....	W. F. Wilkinson 45
Ransome, F. L., Lead-Silver Ores of Wardner, Idaho (c.l.).....	228	Tilley, G. E., Oroville Dredging Co.....	Amos Treloar 219
<i>Rare Metals, Mineralogy of</i>	Cohen and Wootton 462	Timbers, Preservation of Mining.....	E. W. Peters (p.t.) 144
Replacement.....	W. Lindgren (c.l.) 460	Timbers with Wire Rope, Reinforcing.....	(p.t.) 257
Reports, Improving Mine.....	18	<i>Times, The, 40,000th Issue</i>	157
Irestrouquet Creek.....	115	Tin at Poona-Coodardy, W. A.....	338, 426
Reverbratory Furnaces.....	E. P. Mathewson (c.l.) 460	<i>Tin Deposits of World</i>	S. Fawns 305
Rhodesia Copper.....	Report *155	Tin in Nigeria, Prospecting for.....	J. T. Keating *363
<i>Rhodesia, Geological Survey of Southern</i>	306	Tin in United States.....	186
Rhodesia, Mine Tributary in.....	(p.t.) 227	Tin-Silver Ores in Bolivia.....	G. E. Brown (c.l.) 70
Rhodesian Plateau, Sedimentary Rocks of.....	(p.t.) 68	Tingha Consolidated Tin.....	Report 389
Richards' Tin-Extracting Process.....	252, 299	Tolima.....	Report 466
Rickard, E., An Excursion in Cornwall.....	*126	Tomboy.....	Report 388
Rickard, T. A., Coalina Oilfield.....	*283	Toronto Letter.....	36, 189, 265, *340, 432
Persistence of Ore in Depth (c.l.).....	305	Transvaal Gold Mining Estates.....	Report 157
Robinson Deep.....	Report 235	Treasury Gold.....	Report 156
Rogers, A. F., Introduction to Study of Minerals.....	150, 69	Treloar, Amos.....	Cornish Tin Ticketing 219
Rolls c. Stamps.....	J. A. Yule (p.t.) 221	Trevartha-James, W. H., Phantom Profits.....	138
Roofberg Minerals.....	Report 314	Troitzk Goldfields.....	Report 152
Ropes, Hemp.....	Frank Harvey 219	Tropical Diseases.....	92
Rubies, Artificial.....	(p.t.) 148	Tropics, Engineer in the.....	T. Lane Carter *129
St. Ives Consolidated.....	115	Sir A. Keogh.....	289
St. John del Rey.....	Report 73	W. H. E.....	352
St. John del Rey, Temperatures at.....	(p.t.) *66	E. Homersham.....	437
Sakalava Madagascar Oilfields.....	390	Tube-Milling, Pebbles for.....	A. W. An 228
Samples, Mines.....	W. B. Blyth (c.l.) 304	Tungsten, Estimation of.....	(c.l.) 228
San Francisco Copper.....	*31, *109, 184, *267, *344, 426	Tunnelling, Rapid, at Arizona Copper Co.'s Mine.....	(c.l.) 228
San Miguel Copper.....	152	Turkestan, Mining Possibilities in.....	A. Noble *444
Sand, Estimating Tonnage of.....	(p.t.) 382	Turner, H. W., Gossan Outcrops of Cuprifero Pyrite.....	*357
Santa Gertrudis.....	Report 466	Tyrrrell, J. B., Placer Pay-Streaks (c.l.).....	149
Santa Gertrudis Lawsuit.....	166	Union Miniere de Katanga.....	397
Santa Gertrudis, Reports from.....	321	Vanadium Minerals in Colorado.....	(c.l.) 228
Schonberg, A. C., Efficiency.....	295	Vancouver Letter.....	100
School of Mines, Royal.....	*406	Ventilating Fans, Modern.....	(p.t.) 69
Schools, Mining.....	A. G. Charleston 306	Village, Main Reef.....	Report 72
Schwartz, E. H. L., South African Geology.....	390	Vipond.....	*431
Scottish Australian Mining.....	Report 462	Von Bernewitz, M. W., Mining at Bendigo.....	*135
<i>Secretarial Law and Practice, Dictionary of</i>	*181	Waltham Grand Junction.....	P. G. M. 298
Seoul Letter.....	*144	Waltham-Paeroa Tailing Plant.....	C. A. Banks *121
Shaft-Linings, Ferro-Concrete.....	(p.t.) *65	Wanderer.....	398
Shaft-Pillars.....	W. H. Pickering (p.t.) 146	Wanderer.....	Report *156
Shaft-Sinking, Churn-Drill in.....	(p.t.) *156	Wardner Deposits, Genesis of.....	O. H. Hershey (c.l.) 70
Shamva.....	Report 14, 83	Water at Nipissing, Measuring.....	F. L. Ransome (c.l.) 228
Shamva Mines, Plan of Workings.....	*163	Weardale Lead.....	Report *37
Sheba Gold.....	Report 386	Webster, Morton.....	Debutentes in Mining 354
Ships, Corrugated.....	381	Phantom Profits.....	293
Shockley, W. H., Definitions of Ore.....	438	Weed W. H., Butte Geology.....	461
Silver-Lead Deposits of British Columbia.....	(p.t.) 143	Welgedacht Exploration.....	Report *390
Simmer and Jack.....	Report 240	West Africa, Gold Mining in.....	90
Simser Advertisement.....	88	West African Gold Output.....	120
Sissert Estate.....	15	West Australian Mines, Depth of.....	(p.t.) 227
Skertchly, S. A. R., Mexican Oilfields.....	*199	West, H. E., Early Days at Kalgoorlie.....	*135
Skinner's Hydraulic Classifier.....	(p.t.) *63	West Rand Consolidated.....	Report 114
Smelter-Gases, Estimation of Lead in.....	(p.t.) 147	Wheat Kitty and Penhalls.....	Report 154
Speak, S. J., Phantom Profits.....	158	Wilfey's Slime-Concentrator.....	(p.t.) *221
South American Copper.....	Report 114	Wilkinson, W. F., Concrete for Roofing a Level.....	*450
South Crofty Results.....	114	Tin Ticketing.....	45
Southey Cross, West Australia.....	264, 425	Williams, Ernest.....	Cemented Ore 437
Standard Consolidated Tin.....	Report 234	Willoughby's Consolidated.....	Report *89
Standardized China-Clay.....	Prospectus *387	Wily-willy at Kalgoorlie.....	(c.l.) 304
Steel, Exothermic.....	(p.t.) 458	Winding Engines.....	304
Steel Sets in West Africa.....	W. L. Brown (p.t.) *300	Yuanmi Bullion.....	167
Stokess, Ralph.....	Premier Diamond Mine *300	Yuanmi Gold Mines.....	Report 463
Stope-Filling.....	E. K. Hall (c.l.) 69	Yule, J. A., Rolls c. Stamps (p.t.).....	221
Stopes, Measuring.....	O. Tonnessen (c.l.) 304	Zaaiplaats Tin.....	Report 386
Stratton's Independence.....	Report 325	Zinc Corporation.....	Report 74
Stratton's Independence.....	Report 388	Zinc, Electric Smelting of.....	W. R. Ingalls (c.l.) 149
Strauss, L. W., Corocoro District, Bolivia.....	*207	Zinc Extraction Process, French's.....	(p.t.) 223
Sub-Nigel.....	Report 467	Zinc Furnaces, Electric.....	(p.t.) 458
Subsidence-Shocks on the Rand.....	R. N. Kotze (p.t.) 147	Zinc in Montana.....	268
Sulman, H. L., and Kylene Mine.....	378	Zinc in the United States.....	45
Sulphates, Decomposition of.....	(p.t.) 377	Zinc Metallurgy.....	F. L. Clerc (p.t.) *222
Sulphur in Pyrite, Determination of.....	(c.l.) 305	Zinc Smelting, Origin of.....	(c.l.) 69
Sulphuric Acid Manufacture.....	(p.t.) 222		
Sun-Power.....	(p.t.) 382		
Swaziland Corporation.....	162		
Tailing Plant, A.....	C. A. Banks *121		
Talisman Consolidated.....	Report 74		
Talisman Mine.....	24		
Tanganyika Concessions.....	397		

The Mining Magazine

Vol. VII.

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C O N T E N T S.

	PAGE		PAGE
STATISTICS OF PRODUCTION.....	2	ARTICLES	
REVIEW OF MINING.....	3	Alluvial Mining on Goss Moor, Corn-	
PERSONAL.....	9	wall. <i>J. E. Macnamara & H. E. Fern</i>	46
METAL MARKETS.....	10	The Valuation of Base-Metal Mines	
EDITORIAL		..... <i>W. H. Goodchild</i>	50
Notes.....	11	Dredging in New South Wales.....	
Directors as Trustees.....	14	Mining Law in Nigeria..... <i>C. S. Herzig</i>	53
Shamva Mines.....	14	Mining Practices Compared.....	
Sissert.....	15	..... <i>V. F. Stanley Low</i>	58
Perpetuating Enterprise.....	16	Pebbles for Tube-Milling. <i>A. W. Allen</i>	61
Improving Mine Reports.....	18	PRÉCIS OF TECHNOLOGY	
Phantom Profits. III.....	20	Skinner's Hydraulic Classifier.....	63
Definitions.....	22	New Plant at Broken Hill.....	63
Calabashing.....	23	Separation of Zinc and Lead Sulphides	
Talisman.....	24	in Slime by Flotation Processes.....	63
Professors and Business.....	25	Hyde's Flotation Process.....	64
SPECIAL CORRESPONDENCE		Miami Copper Deposit.....	64
Johannesburg.....	27	Shaft-Pillars.....	65
New York.....	29	Prevention of Coal-Dust Explosions..	65
San Francisco.....	31	Examining Coal by X-Rays.....	66
Toronto.....	36	American Copper Production.....	66
Camborne.....	38	Temperatures at St. John del Rey....	66
Kalgoorlie.....	40	Iridosmine in Rand Banket.....	66
DISCUSSION		Sedimentary Rocks of Rhodesian	
Discovery of Tellurides at Kalgoorlie		Plateau.....	68
..... <i>Malcolm MacLaren</i>	41	The Kent Coalfield.....	68
Travel to Northern Nigeria.....		Modern Ventilating Fans.....	69
..... <i>W. Ryan Lewis</i>	42	CURRENT LITERATURE.....	69
Concentration v. Cyanidation.....		BOOKS REVIEWED.....	70
..... <i>A. W. Allen</i>	44	COMPANY REPORTS.....	71
Costs in Nigeria..... <i>Howard Johnson</i>	44	TRADE NOTES.....	78
Cornish Tin Ticketing.....			
..... <i>W. Fischer Wilkinson</i>	45		

STATISTICS

STOCKS OF COPPER IN ENGLAND AND THE CONTINENT.
Reported by Henry R. Merton & Co.

	April 30 Tons	May 31. Tons	June 30 Tons
In England.....	34,686	30,629	28,633
In France.....	6,035	5,259	5,485
Afloat from Chile.....	2,050	1,800	1,475
Afloat from Australia.....	7,000	6,900	6,000
In Rotterdam.....	2,750	1,750	1,350
In Hamburg.....	7,371	6,252	5,195
Total European visible supply.....	59,892	52,590	48,138

AMERICAN COPPER PRODUCERS' ASSOCIATION.
In Tons of 2,240 lb.

	Produc- tion.	Domes- tic	Foreign	Total	Stocks at end of month
October 1911.....	52,792	28,602	26,832	55,425	60,267
November.....	49,945	30,375	29,932	60,307	49,905
December.....	54,865	29,459	35,374	64,833	39,937
Total, 1911.....	639,258	316,791	337,009	653,800	—
January 1912.....	53,272	27,832	35,789	63,621	29,589
February.....	51,801	25,101	28,191	53,292	28,098
March.....	56,114	30,128	26,241	56,369	27,843
April.....	56,011	31,033	23,773	54,806	29,048
May.....	56,570	32,456	31,020	63,476	22,142
June.....	54,605	29,521	27,434	56,955	19,792

PRODUCTION OF GOLD IN THE TRANSVAAL.

	Rand	Else- where	Total	Value
	Oz.	Oz.	Oz.	£
July 1911.....	679,881	29,377	709,258	3,012,738
August.....	682,405	31,002	713,407	3,030,360
September.....	669,773	30,852	700,625	2,976,065
October.....	677,923	30,721	708,644	3,010,130
November.....	291,466	28,267	319,729	3,057,213
December.....	680,782	29,126	709,908	3,015,499
Totals, 1911.....	7,896,802	340,921	8,237,723	34,991,620
January 1912.....	709,280	27,780	737,360	3,130,830
February.....	674,960	28,906	703,366	2,989,832
March.....	796,755	33,968	830,723	3,528,688
April.....	706,763	30,897	737,660	3,133,383
May.....	746,948	32,714	799,662	3,311,794
June.....	722,588	31,348	753,936	3,202,517

* Including 70,143 oz. worth £297,946 extinguished reserve.

COST AND PROFIT ON THE RAND.

MONTH.	Tons	Yield per ton	Costs per ton	Profit per ton	Total profit
		s. d.	s. d.	s. d.	£
1911.....	23,888,260	27 7	18 0	9 7	11,414,863
January 1912.....	2,067,161	27 6	18 10	8 11	997,557
February.....	1,980,336	28 3	19 2	9 2	907,192
March.....	2,163,998	28 1	18 11	9 0	1,204,764
April.....	2,059,562	28 6	19 0	9 8	1,005,920
May.....	2,177,348	28 6	18 9	9 10	1,079,534

NATIVES EMPLOYED IN THE TRANSVAAL MINES.

	Gold mines	Coal mines	Diamond mines	Total
July 31, 1912.....	181,582	8,122	11,054	200,758
August 31.....	179,810	8,182	11,292	199,284
September 30.....	179,619	8,045	11,475	199,139
October 31.....	179,194	8,078	11,319	198,591
November 30.....	176,736	8,043	10,071	194,850
December 31.....	178,282	8,053	8,914	195,249
January 31, 1912.....	184,046	7,896	9,524	201,375
February 29.....	190,320	7,922	10,789	209,301
March 31.....	196,748	8,198	12,071	217,017
April 30.....	197,937	8,364	13,785	220,086
May 31.....	193,829	8,460	14,538	216,827
June 30.....	188,494	8,549	15,530	212,573

GOLD OUTPUT OF INDIA.

Year 1910	Year 1911	June 1912	Year 1912
£2,104,858	£2,150,050	£185,911	£1,114,382

PRODUCTION OF GOLD IN RHODESIA.

MONTH.	1908	1909	1910	1912
	£	£	£	£
January.....	199,388	204,666	227,511	214,918
February.....	191,635	192,497	203,888	209,744
March.....	200,615	202,157	228,385	215,102
April.....	212,935	227,700	228,213	221,476
May.....	223,867	225,032	224,888	234,407
June.....	224,920	217,600	214,709	—
July.....	228,151	225,234	195,233	—
August.....	230,792	228,296	191,423	—
September.....	204,262	213,249	178,950	—
October.....	205,466	222,653	234,928	—
November.....	196,668	236,307	240,573	—
December.....	217,316	233,397	199,500	—
Totals.....	2,526,007	2,623,788	2,568,201	—

PRODUCTION OF GOLD IN WEST AFRICA.

MONTH.	1910		1911		1912	
	Oz.	Value	Oz.	Value	Oz.	Value
		£		£		£
January.....	17,357	70,699	15,903	66,107	26,098	107,262
February.....	16,976	68,469	15,179	63,081	25,009	102,270
March.....	16,637	71,954	16,387	67,637	27,228	111,576
April.....	16,363	67,069	17,730	70,380	27,790	114,796
May.....	16,590	68,355	24,427	96,409	28,015	115,678
June.....	17,194	70,988	22,555	92,174	—	—
July.....	15,564	58,551	22,510	91,955	—	—
August.....	13,921	57,713	25,385	103,753	—	—
September.....	11,497	47,746	26,717	109,039	—	—
October.....	13,341	55,046	26,826	109,503	—	—
November.....	14,021	57,658	24,289	99,299	—	—
December.....	15,042	61,737	24,369	99,569	—	—
Totals.....	185,493	755,985	261,784	1,069,442	—	—

PRODUCTION OF GOLD IN WESTERN AUSTRALIA.

MONTH.	Export oz.	Mint oz.	Total oz.	Total value
				£
Total, 1910.....	363,496	1,209,856	1,573,352	6,682,042
Total, 1911.....	160,021	1,210,447	1,370,468	5,823,522
January 1912.....	10,697	95,673	106,370	451,828
February.....	10,441	92,091	102,532	435,526
March.....	408	92,597	93,005	395,058
April.....	10,698	99,708	110,406	468,972
May.....	9,288	98,104	107,392	456,170
June.....	1,214	106,930	108,144	459,603

OTHER AUSTRALASIAN GOLD PRODUCTION.

	1910	1911	June 1912	1912
	£	£	£	£
Queensland.....	1,840,337	1,623,390	139,350*	615,920*
New South Wales.....	803,727	769,353	37,461	332,632
New Zealand.....	1,896,322	1,088,049	50,191	784,243
Victoria.....	2,422,700	2,138,000	157,600	968,400

* May figures only.

SALE OF TIN CONCENTRATE AT REDRUTH TICKETINGS.

	Tons	Value	Average
Year 1911.....	615½	£702,599	£114 4 5
Jan. to April 1912.....	221½	£263,116	£118 19 0
May 13.....	227½	£29,380	£129 2 10
May 28.....	286½	£36,653	£128 0 11
June 10.....	231	£29,415	£127 16 3
June 24.....	273½	£34,762	£127 2 0

* EXPORTS OF TIN AND ORE FROM STRAITS AND BOLIVIA.
Reported by A. Strauss & Co.

	1911 tons	June 1912 tons	1912 tons
Metal from Straits to Europe and America.....	55,135	4,309	28,712
Metallic Content from Bolivia to Europe.....	22,577	2,400	10,307

REVIEW OF MINING

INTRODUCTORY.—In these rare summer days we see more interest in cricket, boating, and racing, at the Oval, Henley, and Ascot, than in business. It is a slack time on the Stock Exchange. We Britishers take our holidays as seriously as the Mexican takes his recurrent *fiesta*; we hug the tradition that a few weeks must be devoted each summer to a sojourn beside the sad sea waves and the strip of verdant turf on which white flannels desport themselves with an intensity worthy of a noble cause. Meanwhile we postpone business for a more convenient occasion. Thus the markets at this time exhibit a severe case of summer lethargy, aggravated by the sequelae of sundry fiascos. In addition, the brokers and jobbers have been quarrelling over commissions and the Stock Exchange has established new rules that are not wholly popular. Uniformity, simplicity, and fairness in the collection of commissions on the transfer of shares are qualities urgently needed. This part of the business is done much better on Wall Street than on Throgmorton Street or even in the office of the *Daily Mail*.

TRANSVAAL.—The May statistics were satisfactory as to gold but disappointing as to labour. We are frank to say that the decrease in natives employed was what we anticipated, but apparently the shutting of eyes to the facts had caused other people to expect a more satisfactory statement. The yield of gold was 779,662 ounces, worth £3,311,794. This is the best monthly output recorded, with the exception of March, when the total was 830,723 ounces, owing to the extinguishing of gold reserves amounting to 70,143 ounces, worth £297,946. The yield for June is given at £753,936, worth £3,202,517, making the total for the first half of the year 4,478,764 ounces, worth £19,297,044, as against 8,060,437 oz.,

worth £34,991,620 for the whole of the year 1911. In May the mines of the Rand yielded 2,177,348 tons, the yield being 28s. 6d. per ton. The tonnage showed an increase of 117,776 tons, while the grade remained the same as in April. The so-called profit was 3d. less, at 18s. 9d., while the 'total profit' (of which about 75% only is real profit) aggregated £1,073,534.

The number of natives employed on gold mines at the end of May was 193,829, as against 190,392 at the corresponding date a year previous. The decrease was 4108 as against April. Last year the decrease was 3936. During the next two or three months further decreases may be expected, for it is due to seasonal migration of the Kaffirs. In June the decrease was 5335, bringing the total employed to 188,494, as against 186,940 this time last year. The Chairman of the Crown Mines acknowledged that the inadequacy and inefficiency of native labour curtailed the profit won during the past fiscal year. Higher recruiting expenses and increased wages were also unpleasant factors. The Crown Mines employs natives equal in number to 14 battalions of infantry, houses them, feeds them, and instructs them to perform work previously unfamiliar to most of them. They come from different tribes and speak various dialects. Hence efficiency of labour is scarcely attainable. An agreement among the big groups in regard to recruiting native labour has been finally reached. Among those participating is the Farrar group, but not the Robinson. It is probable that the co-operation will prove economical, putting an end to suicidal competition. In October the recruiting agencies are to be merged and will be directed by an advisory board, with Mr. H. M. Taberer as general manager.

The Central Mining Corporation has withdrawn from the Mines Trials Committee, formed to test new inventions on a co-operative basis. We are informed that this means no cessation of research and experiment on the part of the metallurgical engineers associated with the Corner House, but a decision to do it independently of the other groups.

The transfer of the technical management of the Luipaard's Vlei from the Consolidated Gold Fields to Ehrlich & Co. is signalized by the appointment of Mr. C. B. Saner as manager. The banket cut in the shaft of the Government Gold Mining Areas averaged 7 dwt. for a width of $2\frac{1}{2}$ feet. This is deemed encouraging.

The fear that the dividend to be paid by the Rand Mines would be diminished proved unnecessary, the declaration being for 110%, as last year. The Geduld's guaranteed offer to its shareholders of 125,000 new shares at par received an excellent response, 75% being subscribed. The Apex-Benoni consolidation has not been effected owing to the controlling company, the Anglo-French, being unwilling to accept Mr. C. D. Leslie's appraisal. The Federation Company's suit against the City Deep was reported as having been withdrawn, justifying the directors' assurances on the subject. This, however, was denied next day by the lawyers on the other side. The dispute is to be appealed to a higher court.

RHODESIA.—The May statistics were pleasing compared with the immediately preceding months, but unsatisfactory as compared with July and August of last year. The gold output in May was worth £234,407, as against £221,476 in April, £237,516 last July, and £243,712 last August. The Globe & Phoenix continues to be the most productive mine, yielding 10,243 ounces, as against 9485 oz. in April. The Lonely Reef and Eldorado exhibit small increases.

If all goes well the Shamva mill is to begin crushing a year hence. The total ore developed

is about 2,000,000 tons averaging 5 dwt. gold per ton. Sampling in bulk is said to have confirmed the assays. The ground at the 3rd level is disturbed and the orebody is less regular, but of good grade. Mention of water below the 3rd level suggests that the critical point has been reached in the persistence of the ore.

The outlook for water in the Matabele province of Rhodesia is decidedly bad, for the rain has been extremely scanty, and the dry season has now commenced. This will affect the Gaika, Globe & Phoenix, Selukwe, and Gwanda mines.

WEST AFRICA.—The May statistics, issued on June 17, were again satisfactory, for the output of gold is the best on record. It was 28,015 ounces, valued at £115,678, as against £114,796 in April and compared with £96,409 in May 1911. The increase is well distributed, each of the productive mines yielding about the same as usual. The Ancobra Dredging Co., although one of the minor contributors, makes the biggest gain with 801 ounces, as against 475 oz. in April. The Ashanti Goldfields, with a production of £40,554, and the Prestea, with £25,125, remain at the head of the list.

It is announced that 15 stamps were started on the Abbontiakoon on July 1 and that the entire mill of 25 stamps will be at work on July 20. This is a resumption of milling after three years devoted to mine development. At the Prestea it has been found necessary to cease hoisting through the main shaft, which needs to be re-timbered for 150 feet below the 3rd level. While these repairs are being made the manager expects to hoist 250 tons daily through the Appantoo shaft, but this will not suffice to maintain the returns, which for two months will show a considerable diminution.

The Abosso-Taquah amalgamation scheme apparently has been abandoned. The annual report of the Abosso company is a frank statement. We note that 298,000 tons of ore having an assay-value of 41s. per ton is fairly assured.



TIN READY FOR TRANSPORT.



TRANSPORTING TIN.

The total cost last year was 34s. 7d. per ton, including development and London charges. For the last nine months the cost was 27s. per ton. The work being done by the West African Trust on the N'Tubia concession is giving encouraging results, for at the 100-ft. level the drifts extended for 80 ft. show 2 ft. of ore assaying 25 dwt. per ton. At the Anfargah the results are likewise highly promising.

The Benue report confirms the criticisms that have been made in these columns. We warned the public that the so-called tin output of Nigeria in some cases consisted merely of a low-grade concentrate. It appears now that the "good grade concentrates" announced by monthly cables from the Benue last summer were found to contain only one-third black tin, that is 26% metallic tin. Now Mr. Matthew Francis, the new manager, states that this concentrate is of doubtful value and will require magnetic separation. His opinion has been confirmed by a later test in London. Mr. R. Pawle, now consulting engineer, states that records of work done at the mines are lacking. Prospecting operations as yet are inconclusive. Shipment of expensive machinery is not justified. The properties need systematic testing. The water and labour supplies are both scanty and require careful attention. Mr. Pawle concludes by saying that "the future is distinctly promising, and tin ore will ultimately be won at a fair profit." This sounds like the opinion of an intelligent engineer and is in vivid contrast to the reckless statements made by the late manager.

In *The Times* of July 4 there appeared a judicious letter from Mr. Frank N. Best, the chairman of the Naraguta. He asks for patience and more working capital. Labour for the tin mines, in his opinion, is sure to continue scarce on account of the railways and other public works. He deprecates the increase in wages and the competition for labour between the managers of mines. Mr. Best criticizes the administration of the Mines

Department and makes several good suggestions. He is hopeful of the Jemaa lode proving profitable and deprecates pessimism, but as to this only the opinion of a competent mining engineer can carry weight.

The bore-holes at the Giant will stimulate speculation in the shares of that company, but no definite news is to hand. The Cam & Motor is finding more ore on the 5th level, but it is low-grade. It is rumoured at Elisabethville that some of the smaller mines of the Tanganyika Concessions are to be let on tribute, the ore being smelted at Lubumbashi. An American engineer "of great experience" is expected to push matters forward. This is interesting, if true. Somebody "of great experience" in copper smelting is needed.

The rains have come in Nigeria and promise an expansion of alluvial mining. Labour is scarce, as is usual at the beginning of the rainy season. The rise in the river has allowed the Niger Company's largest stern-wheelers to ply on the Niger between Lokoja and Forcados. A telegraph line is to be in operation to the Jemaa district by August.

AUSTRALASIA.—Mr. G. D. Delprat's mission to Europe and America is to bear fruit shortly. An American expert, who has investigated local conditions at Iron Knob, which is on Spencer's Gulf, opposite to the Port Pirie smelting works, has reported favourably on the scheme to erect an iron and steel plant. The Broken Hill Proprietary will raise the necessary capital, which runs into large figures. This is the first real effort to start an iron industry on an adequate scale in Australia. Private cables mention that negotiations are proceeding for the amalgamation of the North Broken Hill, the British Broken Hill, and the Amalgamated Zinc companies. It is obvious that any contemplated merger would be strengthened by including one of the large treatment companies. At the Great Fitzroy a resumption of ore treatment has been made with fair results, yielding a small profit, on

which decided improvement is assured for July. The higher price of copper helped the June output, as against last November, but on the other hand, abnormal expenses had to be met in June. At the Mount Morgan the new smelting plant, with the recent adjustments advised by Messrs. Audley Smith and Deane, is now doing well. An increased output of copper is assured. The Golden Horse-Shoe developments are not as good as they read, the real average of the new ore being only about 6 dw. per ton. Mount Elliott has declared a dividend of 7s. 6d., the June return including 100 tons of copper more than the average, as it came from a special clean-up. Mount Oxide is a new issue, based on a promising copper mine in the Cloncurry district of Queensland. As further extensive development is required it is likely that the working capital, which is small, will have to be increased before a complete plant can be erected. This would involve financial re-organization. The ore is high-grade, averaging 15% for a width of 25 feet, according to a report by Mr. Gerard W. Williams.

Drought is affecting many mines, not only in Rhodesia. The Mount Boppy has had to pass its dividend, as only 30 stamps have been running, using mine water. Meanwhile the new reduction plant for the sulphide ore is being hastened to completion.

The Great Cobar proposal to redeem the debentures has been withdrawn, the directors co-operating with the protesting debenture holders.

SIBERIA.—Business in this part of the world will be facilitated by the reduction in telegraphic rates. From July 1 the rate from London to any part of Russia in Asia, including Siberia and Bokhara, was reduced to 4½ pence per word, as against the price of 1 shilling formerly charged for this service. We refer to the Sissert flotation on another page.

UNITED STATES.—The Miami has paid a dividend of 10%, and is thus the first of the

disseminated copper mines in Arizona to make a return to shareholders. A drill-hole sunk 120 feet below the 570-ft. level went down in ore all the way and indicates that the orebody extends deeper than was anticipated.

In Colorado there is some excitement over an alleged discovery of gold-bearing conglomerate, similar to that of the Rand, in the foot-hills near Parker. There is talk of a huge consolidation of Cripple Creek mines with the El Paso as a nucleus, to be capitalized for \$35,000,000. Representatives of French bankers are said to be examining the properties. We await their report with interest.

Our American friends have been almost too occupied with politics to do much business; yet the undertone is strong. Grain prices have fallen, presaging abundant harvests. The hay crop in America is bigger than the gold output. On the harvest the prosperity of the country is largely based. Copper shares have sagged, as was natural after the recent rise. The metal at 17¾c. is high enough, as we point out elsewhere in this issue. It may be taken that when aluminium begins to displace copper for electric transmission (as is the case just now in a large hydro-electric scheme at Los Angeles) it is time to recognize that the price of copper has risen beyond the economic limit. Until the Presidential election is over, no general increase in speculation is likely. It remains to be seen whether the republican form of government in the States is to be a "democratic organization of capitalist rule," as Kropotkin phrased it, or whether it is to develop healthily into a better form of representative government. Our correspondents at New York and San Francisco send letters of unusual interest, in which the bearing of politics to business is fully discussed.

CANADA.—The satisfactory results being obtained by the two British companies operating at Cobalt is a gratifying feature of Canadian mining. Both the Casey Cobalt and the Cobalt Townsite companies are doing well.

This may draw renewed attention to a district that retains much more vitality than is usually supposed.

A Rhodesian company, the New Rhodesia Mines, has extended its interest to Porcupine, where the property of the Porcupine Krist Mines has been taken under option, subject to the examination of Mr. H. Ewer Jones.

The White Horse copper deposits, after long delays, are now being worked by the New Atlas Co., controlled by the Close brothers, of London, who are also the dominant owners of the Yukon & White Pass railway. About 250 tons of copper ore is being shipped daily to Tacoma. It is stated on good authority that a new railway to open the interior of the Yukon and Alaska is to be built from Haines, on the Lynn Canal, up the old Dalton trail, along the Chilcat river, to Kluane lake and the White River country, thence to Fairbanks.

In a recent issue we referred to an amalgamation of interests in the Klondyke watershed. This has now been effected, the holdings of the Granville Mining Co. and those of the Canadian Klondyke Mining Co. passing to the Boyle's Concessions, Ltd. A sum of £300,000 has been found for working capital. Two big dredges are being built, to be added to the two (one large and one small) now in operation. A report by Mr. J. W. Boyle, an experienced and successful operator in the Klondyke district, has been issued to the shareholders. It has been ascertained by careful tests that once the ground is stripped it is practicable to dredge without thawing, because the winter frost does not overtake the summer thaw. This is a technical fact of great importance to gold-dredging in sub-arctic regions.

MEXICO.—A successful battle at Bachimba, in Chihuahua, and the favourable returns from the congressional elections have further sustained Madero's government. The disaffected elements in the population are gradually coming under control. Floods have interrupted the railway service. At Guanajuato there ap-

pears to have been a repetition, on a smaller scale, of the cloud-burst that caused such havoc in July 1905.

The Camp Bird annual meeting is postponed, so as to synchronize with that of its subsidiary, the Santa Gertrudis. It is announced that the earnings of the old Camp Bird mine are estimated at £230,000, while the dividend from the Santa Gertrudis will be £157,000, making a total of £387,000 available on June 30. A dividend of 4s. is payable on July 25, and £66,000 is carried forward.

INDIA.—The news of most importance from the Kolar district comes from the Champion Reef mine. We have referred several times recently to the encouraging developments at depth, that point to a resuscitation of this mine's palmier days. The latest report states that on the 36th level north of Garland's shaft the lode assays 15 dwt. over 6 ft. In the section round Glen's shaft, a winze sunk from the 38th level south shows a lode assaying 2 oz. 7 dwt. over 1 ft. On the 37th level the lode is 5 ft. wide and assays 2 oz. 3 dwt., while on the 36th level it is 4½ ft. wide and assays 2 oz. per ton. In Carmichael's section the lowest level, the 42nd, is in ore assaying 28 dwt. over 2 ft. Altogether the most recent results are encouraging, and the market value of the shares is rising. Last month we referred to the excellent developments at the North Anantapur. The importance of this venture in Indian mining is accentuated by the report of the parent company, the Anantapur Gold Field, which is continuing prospecting work in other portions of the old workings.

VARIOUS.—A concession for 76 years for the utilization of water-powers in the Caucasus has been granted by the Council of the Russian Empire to Mr. C. H. Stewart, of Alexander Hill & Stewart. This represents the final outcome of long sustained effort and presages the organization of a large scheme for transmitting electricity to the mining regions of the Caucasus.

PERSONAL

W. H. ALDRIDGE now has his office at 14 Wall Street, New York.

ROBERT H. ANDERSON is returning to Mexico City, after a holiday in Europe.

J. ARTHUR, of St. Austell, has returned from Korea.

G. PERCY ASHMORE has returned from Java.

W. J. BARNETT has returned from a visit to Algeria and Morocco.

MONTAGU BARNEY is back from Nigeria.

M. W. VON BERNEWITZ has been appointed assistant-editor with the *Mining and Scientific Press*, at San Francisco.

GEORGE H. BLAKEMORE is returning to Australia.

W. H. BORLASE, on his return from Norway, will proceed shortly to Northern Nigeria.

F. W. BRADLEY has been making his usual tour of inspection in Idaho and Alaska.

R. GILMAN BROWN is due from Kyshtim.

J. W. BRYANT, on his return from the Yukon, has gone to Vancouver.

GEORGE P. CHAPLIN has returned from Madagascar, whither he went for BRUCE MARRIOTT & COMPANY.

HENRY CLAY CARR has returned from Spain.

J. J. COLLINS has returned from Nigeria, on a holiday.

FRED. G. CORNING is taking a holiday in Europe.

A. H. CURTIS has left for the oilfields in Japan.

G. E. DAVIS has recently returned from Northern Nigeria.

LOUIS DUPARC is making a geological survey of the Sissert district.

ROWLAND FEILDING was in Spain recently.

H. J. GIFFORD has left Kolar, India, for a holiday in England.

E. MACKAY HERIOT is in Spain.

E. C. HOMERSHAM and G. A. GARDNER are here on furlough from Prestea, West Africa.

DAVID GILMOUR, late of the Randfontein Central, is in London.

VICTOR G. HILLS was recently in the White Horse district of the Yukon.

C. BARING HORWOOD is expected to sail from Cape Town on the *Walmer Castle* for England.

HENNEN JENNINGS is here.

H. EWER JONES has returned from Rhodesia and is now on his way to Porcupine.

E. S. KING & Co. have accepted the management of the Tresavean mine, Cornwall.

D. LAMONT returns to the St. John del Rey mine at the end of this month.

WALDEMAR LINDGREN is resigning from the United States Geological Survey, to become head of the geographical department of the Massachusetts Institute of Technology.

S. H. LORAM is here from Valparaiso.

E. P. MATHEWSON delivered the commencement address at the Montana School of Mines.

FERDINAND MCCANN has resigned as manager of the El Tajo, and has opened an office in Mexico City.

PHILIP N. MOORE is at San Francisco.

H. E. NICHOLLS, engineer to the Jos Tin Area, is home from Nigeria.

CYRIL E. PARSONS is consulting engineer to the United Rhodesian Goldfields Co., with an office at Salisbury.

A. C. PERKINS, of F. W. Payne & Co., is in the Malay States.

LAURENCE PITBLADO has changed his address to 3 Featherstone Buildings, High Holborn, W.C.

W. A. PRICHARD was recently in California.

FRANK H. PROBERT is on a visit to London.

HORACE P. ROBERTSON has returned from Nigeria.

WILLIAM R. RUMBOLD sails for Nigeria on July 24, as chief mining engineer to the Niger Company and as consulting engineer to the Anglo-Continental Mines.

C. R. SAMS has returned to England, after spending 7 years in Spain.

T. S. SAUNDERS is on his way back to Teziutlan, Mexico.

HENDERSON SCOTT is at Porcupine.

W. E. SIMPSON has returned to the City of Mexico.

MARION L. THOMAS is at the copper mines of Wicklow, Ireland.

H. L. TWITE, of Twite & Steinhart, is in Portugal.

A. C. VEATCH is at the Hotel Cecil.

GERARD WILLIAMS, recently special correspondent to *The Times*, has returned from Australia.

C. H. WRAY has returned from Nigeria.

METAL MARKETS

COPPER.

Average prices of cash standard copper:

June 1912.	May 1912.	June 1911.
£78. 6s. 10d.	£72. 10s. 5d.	£56. 9s. 10d.

The upward movement has continued throughout June until on the 20th amid excited dealings £80. 15s. was realized for three months standard copper, a rise of £4. 15s. from the beginning of the month. A New York report published in a leading newspaper on the 24th stated that there were large hidden stocks and that the rise in prices was artificial. A stampede on the Metal Exchange ensued, which brought prices down £3 in a single session. There was, and has continued up to the close of the month, much realizing by speculators, who have mostly retired with handsome profits. The offerings have been well absorbed, however, and prices have recovered somewhat from the lowest. The advance has been hastened by the stoppage in supplies of electrolytic copper from the various American refineries through strikes. In addition to the trouble at the Baltimore and Balbach plants, an even more serious situation developed at Perth Amboy, and shipments had to be suspended. There was a consequent run on stocks in European warehouses, which still continues, for it will take two months before production can proceed at full swing again. The stock of refined copper in store on this side, however, is almost depleted, and it is not possible that the present rate of warehouse deliveries can continue much longer. The present world's stocks are less than 4 weeks demand, and are at a dangerously low level. American electrolytic copper has been advanced from 17c. to 17½c. during the month, and the producers are sold out till September. There is no sign of any fall in the phenomenal consumption.

TIN.

Average prices of cash standard tin:

June 1912.	May 1912.	June 1911.
£205. 18s. 9d.	£209. 6s. 1d.	£207. 7s. 9d.

The market has been under the influence of the London transport strike. Stocks in warehouse are almost negligible, and supplies both for American and English consumers have been delayed by the difficulty of transshipment. In face of the unflagging demand, prices have remained high, and the fluctuations, although frequent, are not of the wide range to which the market is accustomed. Speculation is not prominent and indeed un-

der the conditions prevailing is unattractive. Spot deliverable tin has been held for high premiums, as works were faced with the alternative of paying the price or closing. In consequence of this and the indifference of speculators the backwardation has widened. The East, although selling daily, does not dispose of large quantities, while in America the scarcity of tin is pronounced. Fresh supplies are not being brought forward, in the way the industry would desire.

LEAD.

Average prices of soft foreign lead:

June 1912.	May 1912.	June 1911.
£17. 11s. 8d.	£16. 10s. 2d.	£13. 5s. 5d.

The advance in price has been fast and takes buyers with surprise. Demand by white-lead manufacturers, and for the electrical industries is exceedingly active, while supplies are still interrupted by industrial disturbances. Smelters appear to be sold out for the next two months, and are refusing to quote for delivery earlier than September. Speculators, who have made good profits, sold freely at about £17. 10s., and tried to depress the price and buy back, but the market went ahead to £18. 2s. 6d., and still has the appearance of great strength.

SPELTER.

Average prices of ordinary brands:

June 1912.	May 1912.	June 1911.
£25. 11s. 10d.	£25. 11s. 2d.	£24. 9s. 7d.

Business is active and prices steady with an upward tendency. On the Continent the convention has raised prices 5s., but has refrained from altering the English quotation as yet. Galvanizers appear to have plenty of work on hand and in prospect.

OTHER METALS AND MINERALS.

Prices quoted on July 10:

SILVER.—28d. per oz.

PLATINUM.—185s. per oz.

BISMUTH.—7s. 6d. per lb.

ALUMINIUM.—£73 to £75 per ton.

NICKEL.—£170 per ton.

ANTIMONY.—£26 to £27 10s. per ton.

QUICKSILVER.—£8. 5s. per flask.

MANGANESE ORE.—8½d. to 11d. per unit (1%)

IRON ORE.—Cumberland hematite 26s. per ton at mine. Spanish 21s. 0d. delivered in England.

PIG IRON.—Cleveland 57s. per ton. Hematite 73s. per ton.

WOLFRAM ORE.—28s. per unit (1%).

EDITORIAL

IT is stated that Mr. Edmund Davis protests that he has not sold a share of Anglo-Continental. We rise to ask: Why not?

THE ANNUAL consumption of whiskey in Rhodesia is £24 per head. No wonder our Rhodesian friends thought that a boom was over-due.

SEARCH FOR OIL and the winning of petroleum now constitute an important branch of mining. It is a notable fact, however, that lectures on this subject are lacking in most Schools of Mines, particularly our own at South Kensington.

DIFFERENCES between prominent operators on the Rhodesian market are said to explain the dulness in share-dealing. If the settlement of these differences means another harmonious effort to deceive the public, we hope an agreement will be postponed.

POLITICS affects business in the United States to so large a degree as to render the Presidential Election important even to those engaged in winning the metals in other countries. Hence the references to the subject appearing in our New York and San Francisco letters will be appreciated, especially by readers in remote regions.

SPEAKING OF OIL, we note that our good friend Captain Anthony F. Lucas, famous as the discoverer of the Beaumont gusher, has had to defend his claim as the originator of the dome theory in its application to the discovery of oil in the coastal plains of Texas. Geologists have accorded him this honour for a decade and we marvel at the hardihood of anyone who now questions it.

We feel sure that he will hold the fort against any attack frontal or on the flank.

AMONG the humorous incidents in connection with the Nigerian department is the attitude of the chairman of the South Bukeru. It appears that the first manager, Mr. E. Brereton Kent, gave a highly favourable report, which his successor, Mr. W. J. Shepherd, could not confirm. Whereupon the chairman states that he has greater confidence in Mr. Kent than in Mr. Shepherd; and that he was sending Mr. Kent to show Mr. Shepherd where the tin was to be found.

THE DISASTER at the Cadeby pit, whereby first 30 miners were killed by a gas explosion and then 42 rescuers shared the same fate by reason of a second explosion, finds a melancholy coincidence in this issue of our magazine, because our Précis of Technology happens to contain the abstract of an article on shaft-pillars by W. H. Pickering, the Inspector of Mines who headed the rescue party and gave his life in an unavailing effort to help others.

IT IS STATED that Mr. W. Fischer Wilkinson is succeeded as Principal of the Cornish School of Mining by Mr. J. J. Beringer, who was formerly in charge. Most of the local people will be glad to see Mr. Beringer again at his old post, but the appointment is an acknowledgment of plans that have gone wrong. Mr. Beringer is to be aided by Mr. Frank Michell, as lecturer on mining, with Mr. Ian Shepherd, as manager and instructor at the King Edward mine, the mine attached to the School for the purpose of practical training. It is ten thousand pities that the Camborne School gets so little support.

Cornishmen have taught the world so much in mining; it seems strange that among their many beneficiaries there has not appeared a millionaire willing to endow the Mining School handsomely.

THAT mineral exploration in Northern Nigeria is occasionally attended by danger is proved by the death of Donald Andrew Campbell, who was killed by natives in the province of Nassarawa, a wild region and difficult of access. The natives objected to his placing white flags on the beacons erected to mark surveys, declaring that these were the white man's *juju* for preventing the rain from falling. As he declined to acknowledge the local belief, he was murdered in a general attack. Mr. Campbell was in the service of the Lewis Evans syndicate, and had previously gained his experience of West African conditions at the Broomassie gold mine.

JUST after we had gone to press in June it was made known that the South African Government had decided not to proceed with the Estates Duty Bill in this session. We hope it may be shelved for good. The Government has also agreed to contribute £100,000 to meet claims under the Phthisis Compensation Act. These evidences of reasonable goodwill toward the mining industry are appreciated. On June 29 General Botha in a public speech protested against the suggestion that the Government desired to prevent capital from coming into South Africa. On the contrary, they would do everything to encourage the influx of capital, so essential to the development of the country.

CLAIMS for priority in the discovery of tellurides at Kalgoorlie have been made from time to time, eliciting discussion of a personal nature. We are glad to be able to publish a letter from Mr. Malcolm Maclaren, giving the facts, as nearly as they can be as-

certained. The present writer remembers the Maryanski episode. That gentleman, so modest in name, was not manager of the Great Boulder Main Reef mine but only one of the engineers retained by the Venture Syndicate. His former experience in northern California had given him some familiarity with telluride minerals; it was that, and not a German scientific training, that explained his intelligent curiosity on the subject.

LODES were made before mining claims, yet it is not often that a lode plays so fast and loose with artificial boundaries as the Great Boulder vein at Kalgoorlie. First it is in the Great Boulder claim and then it crosses into that of the Golden Horse-Shoe. The west branch of the No. 4 lode, to be precise, in the Golden Horse-Shoe, was 2½ feet wide and assayed 25 dwt. per ton when first cut in the cross-cut on the 2480-ft. level. Since then, on driving, it has widened to 3 feet of 5½ oz. ore. We note that in the opinion of the Great Boulder management "there is yet the possibility that the lode may return to us at the lower depth as it is in the upper levels." It would be a fair thing for it to split and send one branch, preferably richer than ever, into each of the rival claims.

INDIAN gold mining has been almost humdrum in its continued prosperity during the last fifteen or twenty years. A country is happy that has no history, and a mining district is lucky if it has no fiasco. The Kolar has its four steadily productive mines, but it is in the Anantapur district that the fortunes of mining are pleasantly prominent, for that goldfield, after being abandoned by ancient workers, is now yielding excellent prospects, thanks to the energy of John Taylor & Sons. Should they repeat the success won in the Kolar district, even in a less degree, we shall be only one of a great many to tender hearty congratulations.

SKETCHING is almost a lost art among engineers. The camera in its most portable forms has caused them to neglect an aid formerly well appreciated. Even now, however, a skilful hand can bring out the essential features of a topography or a geologic section in a manner delightful to the scientific observer. It is not often that we are favoured with sketches from a distant mining region; therefore we have all the more pleasure in reproducing in this issue four excellent pen-and-ink drawings of scenes in Northern Nigeria made by a young mining engineer, Mr. J. B. Richardson. He has also made some charming water-colour sketches of the Nigerian bush and of the tin country such as should be valued by the gentlemen who were fortunate enough to make money during the recent excitement.

WE PUBLISH a valuable constructive criticism of the mining law as administered in Northern Nigeria. This is contributed by Mr. Charles S. Herzig, who has recently returned from Nigeria. The soundness of his criticisms is suggested by the fact that after the article had gone to the printer it was announced, by the medium of a correspondence between the Chief Secretary and Mr. Astley Cooper, that in future the Inspector of Mines will not be a member of the Advisory Committee, but will be available as an expert on behalf of the Government. As to the latter, objection may be forthcoming, unless this official is of a higher standing than is usual in such appointments. The staff in the Mines Department is to be increased and every effort is to be made to expedite the administration of mining affairs.

THE VOLUME on West Australian metallurgical practice issued by the Chamber of Mines of Western Australia was so highly appreciated that our readers will be glad to learn that the companion volume on the mining practice of that great gold region

is also commanding a ready sale. The Chamber of Mines is to be congratulated on its enterprise. It is in line with the great work recently published on Rand metallurgical practice, to be followed shortly by a similar book on mining methods in the Transvaal. The technical men at Kalgoorlie and at Johannesburg deserve great credit for their public spirit. We hope that similar organizations at other mining centres will follow their example.

AN ACTION brought by Mr. Walter J. Hill Cathrine against the La Martona Rubber Estates elicited some interesting evidence. Mr. Hill Cathrine, a mining engineer, said to be a member of the Institution of Mining and Metallurgy, brought suit to recover £614, balance of fee due from a rubber company supposed also to own mineral lands in Bolivia. His fee was £1000 in cash. The defendant claimed that half the fee was payable in cash or shares, at the option of the company, but plaintiff testified that he had refused to have any part of his fee payable in shares, because "it was inconsistent with his position as a member of the Institution of Mining and Metallurgy." The affair proved a fiasco; on arrival at Puerto Suarez Mr. Cathrine found that no means of going to the property was available and that no funds were forthcoming; he ascertained also that the company had no title to the property. He pleaded that "it was contrary to the by-laws of the Institution to make a report on a property unless the company had a clear title, and if he did so he would be guilty of unprofessional conduct." These are the words of the defendant's counsel. The 'Institution' is called the 'Institute,' and other errors appear. Mr. Cathrine's name is not among 'members,' for he is an 'associate.' Despite these errors, the incident is worthy of note. In the first place, we are glad to say that the plaintiff engineer got a judgment for £614, with costs. We are not aware of the existence of any such by-laws as are mentioned

in the court proceedings. Of course, we endorse the position assumed by Mr. Cathrine in refusing part-payment in shares; it is neither good business nor proper etiquette to take shares in a company having resources as yet unknown, but to be investigated by the engineer whose fee is in question. The Institution has formulated no regulations on this subject, or on kindred matters, but it might prove useful, as stiffening the moral backbone of the profession, if the consensus of opinion of its members were made known by an open discussion, followed by agreement upon a code of unwritten laws embodying some idea of conduct in professional affairs.

Directors as Trustees.

We join with *The Financial News* in commending the course taken by Mr. Samuel Evans in resigning his numerous other directorships in order to devote himself unreservedly to his onerous duties as chairman of the Crown Mines. We have often, in these pages, protested against the idea that any ordinary human being can act as a trustee for scores of companies without impairing the value of his service to any one of them. Scandals such as have hurt the industry of late would be rarer if able and responsible men were willing to take their duties as directors so seriously as to refrain from scattering their energies. Such enterprises as Rand Mines, East Rand Proprietary, Crown Mines, Consolidated Gold Fields, and so forth, require at their head a man of rare ability willing to devote all his time to the management of such big affairs. Only men of rare ability are of any use for the post, and only those of them that are willing to forego a multiplication of appointments. Moreover, such men, preferably versed in the business of mining and not without some technical training, are worthy of a salary commensurate with their duties and responsibilities. A director who takes his duties seriously, not as a privileged speculator but as a trustee for share-

holders, is a professional man in the highest sense of the word. On every board there should be one man—whether called chairman or managing director does not matter—who should have his hands on the tiller with an eye constantly on the compass. Such an experienced navigator among the reefs of technical trouble and the shoals of sanguine speculation is needed by every large mining company. He should preferably be detached from the market game and he should be compensated for such detachment by being paid handsomely for his single-minded endeavours. This may seem ideal, but it is an idea not wholly unattainable. Meanwhile we recognize a decidedly favourable turn of public opinion and we congratulate the shareholders of Crown Mines in having a chairman of so enlightened an intelligence.

Shamva Mines.

Mr. G. R. Bonnard, the chairman of the Amalgamated Properties of Rhodesia, a company holding a large interest in the Shamva Mines, writes to the financial daily papers on July 5 to make clear "the real facts of the position" in regard to that famous new mine in Rhodesia. He takes the ore developed during the year, namely, 1,072,000 tons, of an "average value" of 6'17 dwt. or 24s. per ton, and obtains "the value of the gold in the ore developed" as £1,286,400. From this he deducts the total expenditure incurred during the year in which this ore was developed, and makes allowance for "a total cost" of 8s. 6d. per ton for treatment, making £487,934 to be charged against "the value of the ore," and leaving "a net profit" of £798,466. This he says "should not fail to please the severest critic of any mining company." It certainly might be pleasing if it were approximately true. The term "value," so loosely used by the engineer to the Shamva Mines, and hence misunderstood by Mr. Bonnard, is the 'assay-value,' as ascertained by

sampling. It does not represent the quantity of gold to be recovered in the mill. From the assay-value of the ore must be deducted the loss in milling. Allowing for an extraction of 90%, which is high, the loss would be 10%. Next, the 8s. 6d. is not the "total cost" but the "working cost," as estimated by Mr. H. A. Piper, the consulting engineer to the company. His estimate applied only to the ore that can be quarried. We shall be surprised if the cost at the mine is under 10s. per ton. Similar figures at the Giant and Globe & Phoenix mines have proved illusory. To "working cost" at the mine must be added expenses for administration in London, directors' fees, additions and renewals of machinery, depreciation, royalty and taxes, representing a further expenditure as inevitable as the cost of stopping the ore in the mine or the expense of crushing it in the mill. What that additional expenditure will be, Mr. Bonnard ought to know, if he intends to give reliable information either to the public or to his shareholders through the medium of the Press. We estimate that it will be at least 2s. per ton; adding this to the estimated working cost, and allowing for the loss in milling, namely, 2'4s. per ton, the total deductions amount to 14'4s., leaving 9s. 8d. as the probable net profit. On kindly estimate we venture to say that the actual 'value' of the ore may be about 10s. per ton; thus the net profit on the ore developed during 1911 will be £536,000, not £798,466 as calculated by Mr. Bonnard. He makes an error of 50%. No better illustration is required of the results accruing from the loose usage of such terms as 'value' and 'profit.' Here is the chairman of a big company, controlling important mining interests, so little aware of the meaning of the terms he uses that he over-states the expected profit from a given amount of ore in a mine by fully one-half. To confuse the gold recoverable with the assay-value, and to confuse the profit at the mine with the amount available for divi-

dends, are errors not infrequently made, especially by gentlemen operating in Rhodesia. It is time to put a stop to such blunders.

Sissert.

The publication, "for public information only," of the prospectus of the Sissert Company draws attention to an important group of copper mines in the Ural region. Serious criticism has been aimed at this issue, and not without reason. A little feeling also has been injected into the discussion by the fact that previous negotiations, having in view the acquisition of the property, had miscarried. It is a matter of common knowledge that the Sissert was under option in 1911 to the Russian Mining Corporation and was then examined by Mr. C. M. Rolker. He reported on the property for possible purchasers under the terms of an agreement with which he was not in accord. His findings are in violent contrast to those of Mr. A. L. Simon, who examined the same mines for the present vendors. To complete the record, it may be added that on the initiative of Mr. Leslie Urquhart the Sissert was investigated by engineers representing the Kyshtim Corporation; this was two or three months before Mr. Rolker's inspection. Mr. Rolker rejected the project at a price of £220,000, besides a mortgage of £130,000, making the total consideration £350,000. The Kyshtim Corporation demurred to slightly better terms. Mr. Simon endorses the purchase of the mines for £655,000 by a company capitalized for £1,000,000. In justice to him it must be allowed at once that he has the evidence of another year's prospecting operations and the higher market price of copper. The differences between his report and that of Mr. Rolker are, however, too large to be reconciled. Mr. Rolker allowed no ore as proved; all the ore he included in his estimate was problematical to a varying degree; his estimate was that 1,522,702 tons of ore containing 10,845 tons of copper might

be won, while Mr. Simon finds 23,271 tons of copper in 2,948,774 tons of ore. The latter gives the Gumeshevsky reserve in cubic yards; we have given the equivalent tons. At the time of Mr. Rolker's examination the Sisselsky mine was 175 feet deep; now the lowest level is at 245 feet. Moreover, boreholes have been put down to 412 feet. Mr. Simon appraises the ore above 245 feet as 'proved' and the ore indicated by boreholes to 412 feet as 'probable.' Thus one engineer sees $2\frac{1}{2}$ times as much copper as the other. But the difference does not end here. Mr. Rolker estimates the metallurgical recovery at 70%; Mr. Simon at 88%. One bases his calculations on the results of a preliminary smelting test; the other on the extraction anticipated from a large plant completely equipped. Mr. Rolker puts the profit at £30 per ton of copper; Mr. Simon says £50. As is known, an import duty or bonus of £33 is paid on copper imported into Russia. The whole of this is never paid to the domestic producer. Mr. Simon gives the Sissert credit for £15 on best selected copper; it may be added that on electrolytic copper the net bonus realized is about £24 and on standard copper it is only £12 per ton. The cost of producing copper at Kyshtim is about £35 per ton; Mr. Simon allows £36 for the Sissert. Mr. Rolker's estimate of the total profit to be won from copper is £280,660; Mr. Simon's is £1,145,300. Mr. Rolker does not include the old slags as a source of profit; Mr. Simon expects a profit of £144,000 therefrom. One of these engineers is wrong. This particular estimate is not affected by the date at which the report was made. It is true, copper is £12 higher now than at the date of Mr. Rolker's report. The latter took £84 as an average price for the metal in Russia; Mr. Simon takes £86 for the future and £91 for the current year. A more serious difference is disclosed in valuing the deposits of iron pyrite, for manufacturing sulphuric acid. Mr.

Rolker does not include these deposits among the valuable assets. A market for acid, to make fertilizer, does exist; but the Kyshtim and other works are prepared to supply the material. It is difficult to foresee the extent to which pyrite can be commercially utilized. Mr. Simon states that the 2,000,000 tons of iron pyrite in the Sissert property "will ultimately realize a profit of £650,000"; but it is significant that this source of revenue is not included among his 'assets.' While the prospectus is "for public information only," it is widely advertised; it is also announced that application is to be made for a Stock Exchange settlement on the shares. Thus it is intended to sell shares to the public. As the matter stands, the evidence is too contradictory to warrant any careful man in buying the shares, unless he possesses special knowledge. Obviously the true appraisal of the value of the property and of its possibilities lies somewhere between the estimates quoted. Mr. Rolker represents a disappointed purchaser; Mr. Simon represents a sanguine owner. The divergence of view is too large to be reconciled by a simple division of the difference. If the directors value their reputations and that of their engineer, they will cause the mine to be examined by an independent expert.

Perpetuating Enterprise.

By a coincidence the Waihi and the Esperanza companies held their meeting on the same day, and it was announced by the chairman in both cases that a part of the cash available would be used in seeking and in acquiring a new mine, to be managed by the existing administration. The Waihi and the Esperanza are two of the greatest bonanzas ever uncovered by man, and they serve to illustrate how profitable mining can be at its best. The Waihi, in New Zealand, yielded £9,785,431 from 1890 to 1911, inclusive; adding the output to June 2, 1912, when the

strike suspended operations, the total is £9,990,833. The Waihi Gold Mining Company itself has paid £4,230,585 in dividends free of income tax, so that the money returned to shareholders represents 42% of the gross output in gold and silver. This has come from 4,057,700 tons; hence the average yield has been 48s. per ton, and the dividends 20s. 10d. per ton. Yet this mine that has yielded ten millions sterling in precious metals was originally purchased for £3000. The capital of the company is 500,000 shares of £1 each; these reached a maximum price of £5 $\frac{7}{8}$ in the early part of 1911, and are now quoted at £1 $\frac{3}{4}$. It is not necessary for us to repeat the latest chapter in the history of this great mine; it covers a tardy recognition of the unpleasant fact that the veins formerly so productive have become impoverished in depth for reasons not wholly beyond the ken of a competent geologist.

The Esperanza mine is owned by a company organized in 1903 to acquire a mine in Mexico originally located in 1890 and opened up by August Sahlberg. The mine was a disappointment until 1895; and even then it did not do anything wonderful. The big bonanza was discovered by a drill-hole on the fourth level during October, 1904, just a year after the transfer of the property to an Anglo-American company controlled by the Guggenheim Exploration Company. In 1906 the output of the mine attained its maximum: 207,182 tons, yielding 15,357,690 pesos. The biggest dividends were paid in 1906, the total amount distributed in England in that year being £728,000. Altogether from 1895 to May 31, 1912, the mine has yielded 2,015,125 short tons of ore, yielding £6,170,200 in gold and silver, and profits estimated at £2,386,000. The price paid by the company was £450,000. The English subsidiary company, now in control, is capitalized for £455,000 in £1 shares, and has paid £2,331,875 in dividends. This mine is 1600 feet deep and still has some pros-

pects, especially on a new vein called the San Carlos. The Waihi is 1261 feet deep, and it is proposed to sink the shaft whenever troubles from water and labour are overcome. However, at the annual meetings, held on May 9, it was announced, as we have stated, that the large amount of money in the hands of both companies would probably be used in the acquisition of new property elsewhere with a view to prolonging the life of the two respective enterprises.

This is a step undoubtedly desirable when the administration consists of men welded together by experience and sincerity of purpose, but it is not desirable when the management has no special skill or other qualities of manifest value, worthy of being continuously applied to successive mining enterprises. Some mines are highly successful by accident, simply because the ore deposit uncovered by the prospector has proved so rich as to assure huge profits despite inefficient management; others have been exploited satisfactorily even with a small margin of profit because the best experience and the maximum skill have been applied to the work. On the whole, it may be assumed that even a mediocre management becomes effective through experience, if it be not too obtuse; therefore it is economical to perpetuate it, for transfer to other mines when the original property is exhausted. This is not said with a sardonic smile either at the Waihi or the Esperanza managements. The gentlemen so fortunate as to be identified with the Waihi have won the deserving support of their shareholders, even if we disagreed with their handling of the geologic problem. Those connected with the Esperanza have included several of the cleverest men in the profession, notably Messrs. R. J. Frecheville, A. C. Beatty, and J. E. Spurr. We have, therefore, only to wish both companies a repetition of the success that has identified them with the most romantically successful phase of mining.

Improving Mine Reports.

A couple of years ago when the 'square fathom' was introduced on the Rand to displace the 'ton' as a unit of mine measurement, we commended the underlying idea, which was to emphasize the fact that the chief purpose of exploiting an ore deposit is not the attainment of a minimum cost but the acquirement of a maximum profit per unit of ore excavated. We demurred to Mr. H. F. Marriott's introduction of the 'square fathom,' an old unit in any case, and in no way essential to the accomplishment of his purpose. However, we agreed with him in the idea prompting the change of unit, for every real miner knows, and has known from the time when the Phœnicians landed in Cornwall, that the purpose of mining is not to make holes in the ground but to make money. Some of the mines controlled by the house to which Mr. Marriott acts as advisory engineer have already exhibited a decreased tonnage and an increased profit, notably the City & Suburban and Village Deep. At other mines this policy is being introduced successfully. It is in the best interest of shareholders, provided, of course, they understand that the vitality of the mine is curtailed, as well as intensified, by the refusal to touch rock that cannot be treated profitably. We note also, with pleasure, that the annual report of the Central Mining & Investment Corporation, summarizing the results from the many important mines controlled by the house formerly identified with Wernher, Beit & Co., gives the salient facts in terms that mark a distinct improvement in the use of technical language. The reserves are stated in tons of an average 'gold content.' Such ore is no longer described in the bucolic terms of 'payable' and 'unpayable,' but is divided on a wholly different basis into "ore blocked out and available for stoping" supplemented by "ore in sight which will be rendered available for stoping by current development operations." It would be an improvement to drop

that obsolescent term 'ore in sight' and change the second-class reserve to 'ore to be rendered available by development now in progress.' A more important distinction is now made by Mr. Marriott. He takes the so-called 'working profit' and deducts not only the profits' tax in the Transvaal, but the English income-tax and the French fiscal duties, the expenditure on machinery and plant, as well as the salaries and directors' fees payable at the head-offices in South Africa and London. Thus he arrives at the 'net resultant profit.' At the Village Main Reef, for example, the working profit in 1911 was 19'27 shillings per ton, while the 'net resultant profit' was 15'7s., this being the ultimate profit available for dividends. This is the meat in the cocoa-nut. It is what shareholders want to know and it is what they have the right to know, plainly and unreservedly. Additions and changes to plant, the administration at the head-offices, and sundry taxes are just as much an item of cost as the labour underground or the fuel fed to the boilers. The 'net resultant profit' therefore is, as Mr. Marriott states, "the net cash profit available for dividend purposes and, where required, for re-investment in improvements in the mines to provide increased capacity in the mine or plant." We quote from the Central Mining annual report, where the salient facts concerning the subsidiary companies are clearly recorded. It is a pity that the Village Main Reef Company's report should still speak of "working profit," which is merely a mirage of finance. The 'working profit' is given as 19s. 3d. per ton but the 'net resultant profit' was 15'7s. The so-called total profit was £459,875, but the dividends for the year amounted to £330,400; hence the shareholders received 72%, which is about the usual proportion of so-called profit that finds its way to the proprietors of South African mines. The 'net resultant profit,' as stated by Mr. Marriott, represents 77%. The difference is due to an increased balance carried forward. In another report issued re-

cently from the same office, namely, the Mod-derfontein B. Mines, for March 31, 1912, we note that an estimate is given of the "payable tonnage of ore exposed by drives." A gallery following a lode underground is a 'drift'; it is the result of 'driving.' A 'partridge drive' may be correct; but 'drive' as a synonym for drift or level is illiterate. 'Payable' is pitiful. Is the ore profitable or is it not? If it is, what margin of ultimate profit is assured? However, for the moment, we are content, for we consider the Central Mining's annual report to represent a notable advance in the useful art of giving information clearly. The signs are propitious. A better understanding of the right use of technical terms is evident. We wish Mr. Marriott every success in his good work.

Base Metals.

In our January issue we predicted increased activity in the search for the principal base metals, namely, copper, tin, zinc, and lead, on account of higher prices. Such improvement in the market for these metals is due not only to expanding consumption but to obvious restriction of output, arising from the absence of new and important sources of supply, notably as regards tin and lead. Prices at the beginning of the year may be compared with the current quotations, as follows:

	January £	July 1 £
Copper.....	61	77½
Tin.....	203	207
Lead.....	15	18½
Zinc.....	26	26

The rise in copper is, we believe, justified by the trade statistics, incomplete as they are. Stocks continue to dwindle. The relation between production and consumption in America continues to be the chief factor in regulating the price. It is significant that exports of copper from the United States are estimated to be worth \$110,000,000 for the fiscal year now ending, as compared with \$43,800,000

ten years ago, while during the same decade the imports have increased from 25 to 40 millions. Alaska just now is making a noteworthy contribution, due mainly to the Bonanza deposit, in the Copper River district, but this constitutes no menace, having been fairly gauged. The group of 'disseminated' copper mines in Utah, Nevada, and Arizona, is doing well, but they no longer threaten the market with unknown possibilities of production. They will yield much metal, but the amount is now within the scope of reasonable estimation and is being digested comfortably by a vigorous consumption, due to expanding industrial activity in America and elsewhere. The world's consumption of copper in 1912 is expected to show an increase of 12 to 15%, as compared with the normal annual increase of 7% only. For the past 18 months the consumption has been out-running the production; it remains a question at what price other metals, such as aluminium, or its alloys, can be substituted profitably for copper. On the whole we believe that a price for copper higher than 17 to 17½ cents per pound or £80 to £81 per ton is not to the interest of copper mining, because it incites the adoption of less expensive substitutes.

Tin has not been weakened by the Nigerian hippodrome, despite a real production of metal on a small scale. As far as can be judged now the alluvial mines of Northern Nigeria may yield 50,000 tons of metallic tin during the next decade. Meanwhile the world's output grows sparingly; in 1911 it was only 8½% more than in 1901. The maximum production of 110,580 tons in 1908 compares with 102,770 tons in 1911. Of the old sources of supply, the Straits Settlements continue to yield half of the total, but their output is declining. In 1911 it was 53,670 tons, as against an average of 57,250 tons annually during the preceding decade. The famous Malay islands of Banka and Billiton are barely holding their own, the yield of 15,131 tons in 1911 compar-

ing with 19,365 tons in 1901, and an average of 15,128 annually during the decade 1901-1910. No increase is likely, the Banka sales of tin having decreased steadily since 1903. Cornwall is not now as important as of yore, but the last few years have seen a slight revival, the output of 4500 tons in 1911 being about the same as in 1901, when it was 4566 tons. Bolivia is the one region notable for expansion, the exports having increased from 9670 tons in 1901 to 22,064 tons in 1911, which holds the record. The Yunnan province of China is fairly regular at 4000 tons. Thus the net result is that the world's total output has decreased steadily during the last four years, while consumption has gained. The consumption, chiefly in manufacturing tin-plate, has now absorbed the excess production of previous years, it being estimated that both in 1910 and 1911 more tin was consumed than was produced at the mines. Even the Nigerian contribution will fail to meet the decrease from the Far East, so that all the evidence available justifies the recent rise in the market price of the metal.

As regards lead, the supply at the present time is short of the consumption. The substitution of zinc-white pigments for white lead has hurt the market for lead, but recently other demands, as for piping in electric installations, have increased the consumption. No new sources of supply have been discovered; Missouri, the Cœur d'Alene, Spain, and Broken Hill still yield their output from established mining districts. Burma promises to contribute, but hardly enough to meet a decrease from other regions.

The market for zinc is largely controlled by the Cartel, a Continental trust, which limits the output to the necessities of the market. Just now zinc concentrate is accumulating at Port Pirie, indicating an excess of production from Broken Hill, yet it is a remarkable fact that the mines of the Barrier have been able to supply 20% of the world's production without spoiling

the market. Moreover the Broken Hill production reaches its zenith this year, the exhaustion of the dumps being imminent. Thus we are able to repeat the suggestion that base-metal mining is destined to receive growing attention in the near future.

Phantom Profits.—III.

In the two preceding articles under this title we have shown, by quoting from the reports of reputable companies, that the terms 'cost' and 'profit' are employed with dangerous laxity, and, more especially, that the so-called 'profit' usually, but variously, represents an intermediate stage of book-keeping. If the deduction necessary to arrive at the proportion of 'profit' translatable into dividends were constant, it would be easy to make a uniform correction, but one of the inherent defects of a vicious system is that the proportion varies from almost nothing up to 50%, so that the term 'profit' has become a snare and delusion.

	Working Cost.	Total Cost.	Differ- ence.
Kalgurli.....	19s. 11d.	26s.	30%
Giant.....	15s. 9d.	21s.	30%
Globe & Phoenix ...	27s. 6d.	40s.	50%
Alaska Treadwell...	\$1'55	\$1'63	5%
Tomboy.....	\$4'62	\$4'84	4½%
El Oro.....	\$4'78	\$5'05	6%
Ouro Preto	24s. 2d.	26s.	7%
Knights Deep	14s. 6d.	15s. 3d.	5%
Durban Roodepoort			
Deep.....	23s. 8d.	28s. 3d.	19%

In order to give further point to this criticism, we quote some of the monthly reports published on June 12, the day on which this is written. They include an interim account of operations at such representative mines as the Langlaagte Estate, Randfontein Central, Mexico Mines of El Oro, El Oro Mining & Railway, Broomassie, and Ashanti Goldfields. The Langlaagte Estate and the Randfontein Central report in similar terms. One announces an "estimated profit" of £13,400,

and the other a similar so-called profit of £58,600. On turning to the annual reports of these two companies we find that in 1911 the Langlaagte Estate made "a total profit" of £218,869, of which £130,425, or only 59%, reached the shareholders in the form of dividends, the remainder going to taxes, sundries, and capital expenditure. In the case of the Randfontein Central the "working profit" was £854,241, none of which was available for dividends; it was used for taxes, amalgamation expenses, debenture and other interest, capital expenditure, and so forth. Most of the £854,241 went to defray the cost of the mill and mine equipment; in other words, to capital expenditure. But as an estimate had already been made for this purpose and the working capital previously provided had been exhausted, the use of an extra year's revenue simply means a miscalculation whereby the shareholders have permanently lost a sum that they had reason to expect as profit. It is a loss of estimated profit. As the Randfontein Central is a newly consolidated enterprise there is no means of estimating how much of the monthly 'profit' is a real profit, but the Langlaagte Estate is an old enterprise and it may be accepted that no more than 60% of the £13,400 will go into the pockets of shareholders. In both cases the word "profit" must be discounted to such an extent as to be either meaningless or misleading. The mines of the Rand on average gave 70% of their fictitious profit to shareholders in the form of dividends on account of 1911. On mentioning this matter to a distinguished consulting engineer, he confessed candidly that he estimated 10 months so-called profit as the equivalent of the annual dividends, but this is 83%, which is 9% higher than the average of all the mines of the Transvaal during the last 4 years. The two mines at El Oro are now under diverse control but they are operated under similar conditions. The Mexico's profit for May is given at \$84,190 or £16,838, but "the sum of \$1100

was expended during the month on permanent improvements." Why not include this in the 'cost'? No construction on a mine is "permanent," in the sense of being a fixed asset. Every mine when in active operation requires some expenditure for new equipment. Besides 'improvements' however, the 'profit' must be reduced by deducting for income tax and depreciation, both of which can readily be estimated for inclusion in a figure giving the real cost, and hence the actual profit. Income tax, it is true, is an impost that everybody having income in excess of £160 must pay and it is to be presumed that those whose income escapes taxation, owing to its smallness, are not likely to hold shares in mines. However, it is a tax on mines administered from London and it is in most cases a highly inequitable tax in that no allowance is made for dividends that represent the return of capital. It is not a profit tax. As regards depreciation, we recognize that, apart from the redemption of capital, it may be the setting aside of current profit for future contingencies, as for new equipment, but when reserved for such purposes, and not for distribution to the shareholders, it represents an eventual item of expenditure; it ceases to be profit. In 1911 out of a profit of £184,085, the shareholders received £144,000, or about 80%. The El Oro report for May gives the 'profit' as \$62,910 or £12,582, inclusive of that earned by the railway, but it is stated that deductions must be made for "expenses in London and manager's salary," amounting to £700, so that the net profit is £11,882. Surely the manager's salary and London office expenses are both essential items of expenditure; why cannot they be apportioned monthly and included in the total cost? Neither of them is an extraordinary expense. A sum of \$4160 is set down for "permanent improvements" and is "not included in the above expenses." Why not? The operation of any large mine entails expenditure under this head, and when ex-

pended the 'improvements' do not constitute a liquid asset. Last year out of a profit of £216,430, the shareholders received £172,125 or about 80%. In referring to the El Oro we have an opportunity of correcting an obvious, but not less regrettable, clerical error, whereby in the second article of this series the total profit in three years was stated to have been £453,151 or \$1,206,845. Plainly it should be \$2,206,845. Moreover, the distributable balance at the end of the period was larger than that deduced, so that the total profit for the three years, 1909 to 1911, was £518,605, not £453,151. The yield was \$7'69, the profit \$2'64, hence the actual total cost was \$5'05 or only 6% more than the average "working cost." In the annexed table this corrected figure is given, showing that the Tomboy and the El Oro statements of working cost come close to the actual figure. Any difference is due entirely to our interpretation of what constitutes cost. The two West African mines afford a decided contrast in the manner of their reports. The Broomassie in May had 'working costs' of £4105, to which must be added £1261 for development, £658 for main shaft, and £225 for capital account. Thus the real cost was at least £2144 more than the 'working cost.' In 1911 the output of the mine was £54,211, out of which no dividend was paid. The 'working cost' is given as 44s. per ton, from March to December, but this did not include development redemption, expenditure in London, debenture interest, and so forth. As a matter of fact in 1911 the total cost was about equal to the total revenue, namely, 50s. per ton. Of course, the operation of this mine has not been plain sailing, so that uniform statements of account are difficult, but we submit, in the most friendly spirit, that, as is the case with many other reputable companies, the item 'working cost' has become a delusion and a snare to straight thinking on the financial--and fundamental--aspects of mining operations. The Ashanti

Goldfields is in the unamiable position of setting an example. The monthly reports are a model of explicit statement. Shareholders are informed that "after charging working costs in West Africa, cost of re-treating stamp-mill residues, general expenses in London, Government royalty, depreciation on plant and machinery, and writing off the total cost of mines development for the month" the estimated profit is £17,384. In 1911, out of gold marketed for £428,129, this company paid £152,951 in dividends, and carried forward a balance of £60,681, the costs designated as above absorbing £243,375. Besides the items included in the monthly statement there was a bonus of £10,345 paid to the directors under a special agreement. This now amounts to 3s. 5d. per ton on an output of 60,000 tons per annum. It is a tax that the shareholders agreed to pay to the original owners of the mine and is not in the nature of a fee for services. The propriety of it is not questioned, but as it is a fixed charge on the mine it ought to be included in the 'cost.' As we have said before, any money that does not reach the shareholders in the form of dividends should be treated as part of the 'cost' of mining. The three factors are yield, cost, and profit. All other items of account represent intermediate stages of book-keeping, convenient for the management and useful for analysis, but non-essential in arriving at the central purpose of mining, which is to make money.

Definitions.

Ore is metal-bearing rock that at a given time and place can be exploited profitably. Rock that cannot be exploited at a profit is 'waste.' Better economic conditions, including improved technical methods, may turn 'waste' into 'ore.' The value of an ore is the profit, distributable in dividends, that can be won from it by mining and metallurgy properly applied. As an intermediate stage of book-keeping it is customary, but undesirable,

to speak of the 'operating' profit, that is, the margin left after deducting expenses at the mine, but omitting the further inevitable expenditure entailed by taxes, depreciation, and administration. The nominal market value of the metallic contents as ascertained by assaying constitutes the 'assay-value.' This bears directly, but not conclusively, upon the question of profit, for rock showing a pretty assay-value may exist in places or under conditions that exclude the assurance of profitable exploitation. Rock having an assay-value of 4 dwt. per ton in gold, for example, may be 'ore' in California and 'waste' in West Africa in the year 1912. In the year 1922 an assay of 4 dwt. gold and an assay-value of 16s. per ton may promise a profit even in West Africa, but in 1912, such material is waste, because the total expenses incidental to the turning of the gold into dividends will exceed 16s. per ton. Three items of account are fundamental in the business of mining: yield, cost, profit. All minor items come under these three heads; all should be referred correctly to them. Profit is the ultimate purpose of mining.

Calabashing.

This is a word now frequently used in the reports issued by West African mining companies. Many shareholders and even some persons not devoid of technical knowledge may have looked at the term dubiously or questioningly, as they would regard a new coin of doubtful mintage. Behind 'calabashing' lies the whole technique of tin mining in the alluvial deposits of Northern Nigeria. The calabash is the half of a gourd. The shell or rind of this bulbous fruit is cut symmetrically so as to furnish two dishes or pans. Each of these, on being freed from the interior pulp, makes a 'calabash' from 18 to 22 inches in diameter and 6 to 8 inches deep. It is used as the vanning shovel, pan, batea, lotok, and horn-spoon are used by miners and prospectors all over the world, namely, to wash the

tin-bearing gravel, subjecting it concurrently to a shaking motion, the lighter and valueless material being carried away, while the heavy metallic particles are concentrated at the bottom of the basin. The calabash is lighter than the ordinary iron pan, and is therefore more easily manipulated. It holds 25 to 30 pounds of gravel; that is, from 100 to 120 calabashes equal a cubic yard. A Nigerian native, working from 9 to 10 hours, can treat



Calabashing.

from 15 to 20 cubic feet of gravel per diem, removing the gravel and washing it in the nearest pool or stream. The first concentrate thus obtained carries a maximum of 50 to 60% tin. This concentrate is then dried and winnowed by the native women, employing a dish or platter used by them ordinarily for ridding the husks from Guinea corn, the small-grained cereal peculiar to the West Coast.

This platter is made of rushes ; it is 15 to 18 inches in diameter and $\frac{1}{2}$ to 1 inch deep. The native women manipulate the platter as a Cornishman does a vanning shovel. Moreover, when there is any wind they drop the dry concentrate from one platter to another, so that the lighter particles are blown aside. This resembles the 'dry-blowing' so common at Kalgoorlie in the early days. In some cases this process is replaced by the use of a rudimentary hydraulic classifier or jig, called the Willoughby, a device of Australian origin. By these methods the concentrate is raised to between 70 and 74% metallic tin, that is, 90 to 95% cassiterite. Most of the natives working in the alluvial mines of Nigeria may be regarded as 'tributers,' for they sell the tin concentrate to the representative of a company having licensed rights to the ground. The difference between the market-value of the tin and the price they receive is the measure of their 'tribute' to the company. The standard price, originally a halfpenny per pound, is now 1 penny per pound of clean concentrate. This is the rate authorized by the Chamber of Mines, but it is disregarded by individual operators, who pay up to 6 pence per pound. The tin fetches about 1s. 3d. per pound at London, the cost of transport being £18 to £20 per ton, or $1\frac{1}{2}$ to 2 pence per pound. The profit would be huge if company administration were not so expensive. Practically all the tin produced in Northern Nigeria heretofore has been won by 'calabashing.' In many cases tin exported by concessionnaires has been derived from ground not within the claims to which they had a provisional title. The 'mining' has been mainly the buying of tin, on a handsome margin, from ignorant natives. However, this is good business, seeing that it profits both parties to the deal. Of course, the method of extracting the metal is crude. The recovery is not over 50%, especially if ilmenite be present, for then a heavy loss of tin ensues

through the effort to reject the ilmenite, which is nearly as heavy as the cassiterite. Other minerals beside ilmenite interfere with the concentration and debase the concentrate. We may mention tourmaline, monazite, garnet, and topaz. As yet work has been confined to the richest spots, where, for instance, the alluvial tin has been concentrated against a river bar. Some companies, it may be added, have ground that can only be calabashed, that is, gravel in or adjacent to a stream, and therefore workable only in the dry season. A few have deposits that are well above the stream-level and therefore amenable to ground-sluicing, such, for example, as has been started at the Naraguta and the Rayfield, but other mines do not control water sufficient for sluicing except for a brief period in the rainy season. Thus the 'calabash' will be the principal implement of profitable tin mining in Nigeria for some time to come, and the purchase of tin from natives working on tribute will be the most economical method of exploiting the alluvial deposits.

Talisman.

This mine continues to make a fine showing. It is a remarkable mine, for it has sustained the expectations of pronounced optimists, as expressed in a quotation that has stood for several years resolutely at about £2½, giving the property a valuation of £862,500. At the time of writing the quotation is 2½, representing £776,250. As against this the ore proved and probable stands at £592,000 gross, of which 50% is likely to be distributed to the shareholders. In the year ending February 29, 1912, the bullion produced was worth £236,244, while the dividends aggregated £119,898. According to a director, Mr. George Wilson, the company has extracted ore having a gross value of £1,050,000 in the five years, 1907 to 1912; during that time the dividends have amounted altogether to £599,095, which is a little over 55% on the output. Thus

an assurance of a little more than half of the £592,000, or say £300,000, stands against the market valuation of £750,000. The shareholders are risking something more than half their capital, and all their interest from that capital, on the supposition that the mine will continue to develop favourably in depth. They have done this for several years and have had no cause for regret. Mr. Wilson stated that during the past five years the ore account has stood as follows :

	Reserve in February	Output during the year
1907	221,000	197,000
1908	257,000	208,000
1909	274,000	201,000
1910	205,000	207,000
1911	299,000	236,000
1912	592,000	

This means that during each year nearly as much ore was extracted as had been proved at the beginning of the year ; in other words, as much new ore was developed as had been extracted. This year, however, not only ore proved, but also the probable ore is included in the estimate. Hence its sudden increase. Credit is given to Mr. H. Stansfield, the manager, for conservatism in making his estimates. Mr. Wilson said that they were made " on a safe basis, in the company's interest, and also in order to protect himself," that is, the manager. To this we take objection ; we also question whether Mr. Stansfield would acquiesce in the description of his mental attitude, for an engineer making an estimate should make it sincerely and truthfully, without any such *arrière pensée* as involves a timid under-statement. Having regard to the facts as declared, we infer that the manager is a careful and responsible engineer who has included in his estimate all the ore that should have been included and that he has had an anxious time while trying to keep step with a share-market that has discounted not only the 'proved' and the 'probable' but also the 'possible' ore. In order to pay the capital-

ized value of the mine, about £750,000, plus 10% per annum, the Talisman must yield a gross output of at least £2,000,000 in 6 years. It must continue rich to a depth as yet entirely untested. It has yielded £1,050,000 gross and £599,095 net in the past five years. Evidently an acceleration of output is expected in the next 5 years. It may happen, for the two latest years have exhibited a marked increase of dividends. However, looking to the general experience of mining, especially in New Zealand, we conclude that the robust optimism that holds the shares at £2½ is not likely to be justified.

Professors and Business.

At the recent dinner of old students of the Royal School of Mines, the President of the Institution of Mining and Metallurgy went out of his way to defend the arrangement whereby the professors are allowed, and even expected, to do the work of consulting engineers while occupying the chair of mining or of metallurgy. Mr. Edward Hooper, both as an engineer and as president, occupies an authoritative position and undoubtedly knew that most of his colleagues were in agreement with the views he expressed at the dinner. We have consistently taken an opposite view. It is claimed by many, as it was by Mr. Hooper, that it is to the advantage of a School of Mines that the professor shall keep himself informed by continuing practice as an advisory engineer, since this participation in affairs enables him " to impart up-to-date knowledge " to his students. It is also deemed desirable that the students shall have " personal contact with one who is familiar with almost every phase of mining and metallurgical practice of the present day," and so forth. To this it may be replied that the professor's duty primarily is not to give " up-to-date knowledge " and the details gained in current practice, but to expound the principles underlying the art of mining. For details the

student has his post-graduate apprenticeship. Details vary from year to year, from day to day, while fundamental ideas undergo slow evolution. The purpose of instruction in a School of Mines is not to turn out a ready-made practitioner but to train the mind of the student so that he will think logically, observe carefully, and state accurately. The knowledge won during the three or four years of lectures and laboratory work is negligible; in a year or two it is gone, but the mental bent remains, and long before the scraps of knowledge taken from the lecture room are forgotten the young man has apprehended the realities of work and the basic ideas underlying the business of mining. As to contact with a professor familiar with practical work, it is obvious that actual practice is a preparation essential to effective teaching, but once in the chair it is not necessary for the professor to engage in advisory work, for he can remain in touch by a simpler and less objectionable method, namely, by visiting mines during the long vacation. If he investigates one mine for a fee during the summer holidays, and he is not likely to be able to undertake more than one important investigation, he obtains a lot of data not many of which may be applicable to his lecturing, for the details of operation are not fit subjects for exposition to students, even in the unlikely event of his clients permitting the public use of material obtained while acting in a confidential capacity. Moreover, to confuse a student with details before he has grasped principles is bad teaching. If, on the other hand, the summer months are devoted to a number of visits to mines and reduction works, the professor will gain a variety of information and a wide contact with current practice sufficient to stimulate his teaching and to give him the vital touch with realities that is essential to successful lecturing. It might be supposed likewise that editors of technical journals should practice as engineers in order to remain up-to-date; we can say unreservedly

that it has been found neither necessary nor desirable. More information is obtainable by visiting a number of mines as an honoured guest, under conditions ensuring every facility for gaining information, than by inspecting one mine for a fee. A professor acting as a practitioner is debarred from information that is cordially given to one not connected with the business of mining. We say it is not "desirable" for professors or even editors to act as consulting engineers; it is highly objectionable; both are receiving the support of the profession at large, neither ought to compete with the unattached practitioner. Professors are paid by the tax-payers, they should not take fees from others dependent on their practice for a livelihood. As engineers they may, through no fault of their own, become connected with a fiasco or a scandal. Mining is a queer business at times and it is highly desirable that the professor in a School of Mines should hold himself aloof from the possible entanglements of highly speculative affairs. The same applies to editors. No extraordinary effort of memory is needed to recall cases where men of the highest integrity have been involved in scandals for which they have not been to blame, but the mere connection with one would, and has, hurt more than one professor and the technical college in which he held a prominent post. It is not necessary to dwell on this phase of the subject, we leave it to our readers to supply details. Enough has been said to present our view of the matter. It is one that we have reached not lightly, but by the experience of many years involving work not unlike that of a professor. The editor talks to grown men, the professor lectures to youths; both endeavour to expound the principles of an ancient art and to apply them to modern requirements. To accomplish this it is not necessary to take part in the business of mining; the onlooker who has once played the game is a better observer for being wholly detached from its vicissitudes.

SPECIAL CORRESPONDENCE

News from our own Correspondents at the principal mining centres

JOHANNESBURG.

Burdens of the Industry.—Sir George Albu, having declared his allegiance to the Nationalist party, will find it difficult to reconcile his vigorous opinions on the "inequitable division" of liability under the Miners' Phthisis Bill, approved by the Government, with the "loyal" principles of his political allies. Possibly his new declaration of faith induced him to substitute "inequitable" for "iniquitous"; still, the severity of his denouncement appears none the less decisive and unreserved. The Bill emerging from its

Eventually, the results will be good and phthisis will be to a large extent eliminated, but the price to be paid appears excessive and the contributory proportions are "inequitable" and thus unwise.

Security of Mine Employment.—The remarks of R. W. Schumacher at a smoking concert on the City Deep have proved satisfactorily reassuring to many who consider that changes of staff with changes of management have been too frequent and disturbing in the past to be either just or beneficial. He declared that the practice of new managers put-



VIEW OF MODDERFONTEIN B. FROM TOP OF BATTERY.

reconstruction by the select committee provided (1) for payment of compensation in cases of phthisis already contracted and (2) for insurance in respect of future cases. The liabilities to be incurred under the former head are indefinite, though enormous. The Government will provide £100,000 out of the revenue derived from *bewaarplaatsen*, whilst the mines may have to contribute over a million sterling. This drain, together with that to be met upon the introduction of the insurance scheme, will prove a burden of far-reaching influence, tending to imperil those mining companies now upon the "border line" and also still further discouraging the influx of efficient white miners from other countries.

ting in their own men would be checked in future. Because the practice has been carried to excess in many notable instances, Mr. Schumacher's declaration was wise and welcome. The obvious reservation must be made that the prohibition of changes shall not be carried to the other extreme. There was no attempt in Mr. Schumacher's speech to blink the fact that the Corner House mines have in recent years provided some of the most striking examples of wholesale re-organization. But other groups have not been clear of the blame, and are unlikely to be while mine management remains so largely a matter of men management and the assessment of human merits remains a matter of opinion. The hands

of new managers should not be tied. If they are, there will be no need, in many cases, for the new manager. At the same time, every discouragement should be given to that spirit of upheaval which finds expression by means of indiscriminate dismissals. There have been several "new managers"—now, perhaps, displaced themselves—who have attempted to demonstrate their activity and their ready appreciation of existing defects by noisily "making a clean sweep" and getting rid of the "lot." Then a new "lot" comes in and reform is effected. In Rand mining as elsewhere, new brooms sweep clean. Unfortunately, however, the bristles are considerably worn before it is realized where clean sweeping is really desirable.

The groups that have been guilty of the most unsettled and unsettling policy of volcanic re-organization in the last few years have been the Corner House, Johannesburg Consolidated, Farrar, and J. B. Robinson controls, while the Consolidated Gold Fields, Neumann's, Goerz, and Albu mines have, comparatively speaking, enjoyed a term of unexcitable calm.

Modderfontein Deep Shaft-Sinking.—

The speed of vertical shaft-sinking upon the Rand, under favourable circumstances, is ahead of anything achieved in other parts of the world and our figures are frequently accepted abroad with scepticism. Records in the east Rand are nevertheless authentic. Competition is too keen to permit of dubious statements of linear footage being bolstered by "allowances." The attainment of 234 ft. in a month at the Modder Deep is certainly remarkable. The shaft—one of twin shafts, being sunk 100 ft. apart—is of only three compartments, and is being sunk by hand. While comparisons between the sinkings on the Modder Deep, the State Mines, and the New Modderfontein are justifiable—all being in that easy-drilling quartzitic sandstone, characteristic of the Far East Rand—it would be unreasonable to compare their footages with the results obtained in the Central Rand, where the superior hardness of the rock and the greater prevalence of faults, dikes, and water make an average of over 100 ft. per month a creditable performance.

Native Labour.—The Witwatersrand Native Labour Association has published an interesting analysis of the labour requirements and supplies of the various mining groups as at the end of 1911. The table is of particular topical interest in view of the debated re-organization of the Rand's labour control and

of the influence of group combinations likely to occur. The full complements of members of the W.N.L.A. totalled nearly 300,000, of which 66% were actually employed. Of this aggregate, the Premier Diamond mine accounts for 16,000 with only 56% employed, and the collieries only 8800 with 91% employed. The Corner House mines, several of which are not yet working at full milling capacity, show a total need of 85,500 boys, with 63% employed. The lesser groups stand as under:

	Total Complement.	Employed %
J. B. Robinson.....	36,858	76
Con. Gold Fields.....	33,115	52
Farrar-Anglo-French.....	26,283	77
General Mining.....	22,076	67
Con. Mines Selection.....	21,133	67
Neumann.....	17,001	68
Goerz	10,295	65

The question of labour distribution is again rising into great prominence, for the effects of suicidal competition are being felt in all quarters. Native labour efficiency is on the downgrade and the tendency of changes in wages is continually upward. The large number of tropical natives now upon the Rand has improved the paper position to a high degree, but they comprise a costly factor and their poor stamina has proved a cause of anxiety to those who are responsible for their health and working efficiency. The greater cost of native labour, per unit of work, has been one factor, among others, that has been responsible for the recent increase in working cost.

Mine Inspectors.—It is unfortunate that the failure of the Mines Department, in their prosecution of the managers of the Crown Mines for alleged breaches of the regulations, should have been used by enemies of the Department as a useful weapon of attack upon the efficiency of Government officials. The case against the Crown Mines appeared to indicate lack of judgment and, in some points, lack of straightforward dealing on the part of the Inspectorate, but it decidedly did not give proof of the technical inefficiency of those responsible for the enforcement of the regulations. Whether the supervision provided only certain natives in certain stopes was adequate, or not, must remain, for all time, a matter of opinion. The Mines Department bungled their case and called biased "expert" evidence of a second-rate description, discredited before it was heard. Much valuable time was lost on both sides. The lessons of the case are varied, and, although there is no occasion

to gloat over the failure of the prosecution or to read in it the proof of technical inefficiency, as attempted in some quarters, the affair undoubtedly worked a break in the just and reasonable relationship existing between the Mines Department and the Industry. It is now being declared by some critics that the technical qualifications and experience of the mine inspectors are inadequate for their responsibilities. A good all-round knowledge of working conditions is certainly essential, but thoroughness and a good sense of proportion are still more important for the satisfactory fulfilment of the inspector's unpleasant duties.

A Literary Gem.—If it is possible for the serious question of miners' phthisis to have

this not affect both white and black miners? Forsooth, one need not ask the question. When I say miner, I mean miner, not a gentleman who does three months' work and then takes a symposium of equal duration. These gentlemen I have no time for." This, as a breezy excerpt from an official report, is merely amusing, but a different view must be taken of a medical man's statement that "inhalers are worse than useless underground, as they become choked with dust and the miners simply poison themselves with their own carbonic acid." Such an irrational opinion, too wild to be worthy of discussion, is culpably misleading. Let us hope that it will be fittingly ignored by the many underground men who have the good sense to wear a respirator, when required, in spite of its recognized discomfort.

NEW YORK.

General Outlook.—Underlying conditions throughout the country appear to be steadily improving. In a few months the steel business has risen from a low ebb to the largest volume in years. The anthracite coal strike has been settled. The early prospects for crops are excellent and the copper market is far stronger than the average person appears willing to admit. If one considers how far-reaching these factors are to a general and widespread condition of industrial prosperity it does not appear that those who are inclined to look on the rosy side of affairs are unduly optimistic. The fact that such favourable conditions have not manifested themselves by activity in the stock market may be almost wholly debited to the political situation. On the other hand the uncertainty in this regard has not caused any bad slump. Stocks are neither high nor low; they are extremely dull, and there is much underlying strength to the list as a whole.

Politics.—There is reason to believe that the Chicago and Baltimore platforms will not be as dissimilar this year as Republican and Democratic platforms usually are. No matter who the candidates may be it is practically certain that both parties will have planks more or less similar concerning the control of corporations and a revision of the tariff. Beside these, which are the most important as being sure to affect business conditions, each party is bound to espouse some of the new political tenets, such as the referendum and recall in a greater or minor degree, but legislation arising out of these minor planks is not apt to have much effect on business conditions.



On the Trail.

its humorous aspects, they have appeared in the remarkable range and variety of solutions offered by interested persons, whose honest enthusiasm is unfortunately not balanced by an equal measure of practical knowledge. Occasionally, too, the methods of expression are quaint. One would scarcely expect such opinions as the following to appear in the annual report of Dr. Gem, Medical Officer of Health for Krugersdorp, an important division of the Rand. He asks us to consider "the enormous amount of sputa that has been expectorated down the mines, and nothing is done to eradicate such perilous stuff. Does

The anti-corporation and 'trust busting' crusades cannot be laid at the door of one party more than another. The impulse started in a widespread and altogether justifiable indignation against many real abuses. Like every other widely popular movement it was prostituted by numberless politicians seeking to ride into office as knight-errants of reform. In spite of much that has been grotesque and ridiculous in the revelations of the diverse investigating committees, there is little doubt that they have had the effect of placing business today on a better and more substantial footing than it has been in many years. Certain prominent individuals in the high walks of financial and commercial life have learned to their cost that their operations cannot go on in the future with such a flagrant disregard of all except insiders. On the other hand the general public has become wearied of indiscriminate attacks of all business enterprise and the promiscuous vilification of pretty much every rich or successful man. This mutual enlightenment has had the effect of robbing the politician of much of his thunder, so that no matter if the next incumbent of the White House be Republican or Democrat we are reasonably sure of sane protection for legitimate business.

The Tariff.—Two things must be remembered. In the first place, the duty could be taken off or largely reduced on a long list of commodities without doing any harm whatever to the particular industries in question; they have received protection for so many years that they are now entirely capable of looking after themselves. Secondly, the tariff agitations of the last few years have shown pretty clearly that party lines in this, as in so many questions, have been practically eliminated. As soon as the industries of a particular State are attacked, the representatives and senators of that State stand shoulder to shoulder, quite independent of party, in fighting any reduction there might be to the incomes of their constituents. This was clearly shown in the Payne-Aldrich tariff bill, concocted to fulfil platform pledges after the election of Mr. Taft in 1908. The only tariff bills passed that were in any way likely to cause a general readjustment of trade were passed after the House of Representatives became Democratic in 1910, and those congressmen felt entirely confident that the Republican President would veto the bills, thus gaining for himself the stigma of being a reactionary, while they themselves expected to make political capital in comfortable security. Now, if

the next President is a Democrat, these gentlemen will be much more careful to see that any bill leaving their hands has had pretty much all the life crushed out of it. Consequently although either successful party may pass a bill or bills reducing the tariff, there is only the smallest likelihood that such a bill will be harmful to trade in general.

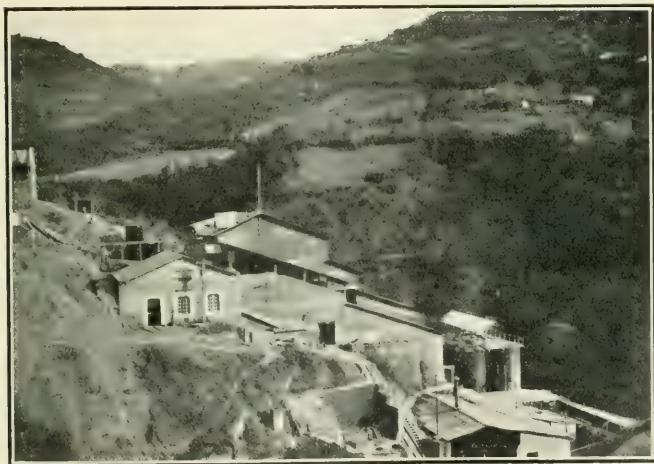
Copper.—With a strong demand for copper at 17½c. and European supplies lowered from 385,038,080 pounds at the end of March 1911 to 112,190,400 pounds today, it is hard to understand the mental attitude of a large number of people who still claim that the whole movement is one of rank manipulation. The upward trend of the movement started, to be sure, in manipulation last autumn when a surplus 50,000,000 pounds "was taken care of" until consumers were made to see that the supply of copper was not inexhaustible and that demand has caught up with output. Once the movement started, however, natural laws have controlled the situation and it is idle to believe that some sinister group of capitalists is holding vast quantities of copper in order to unload around 20c. per pound. There can be no enormous reserve, for the only men who could conceivably be in a position to hold an enormous reserve are the very men most vitally interested in seeing that copper does not reach a price so prohibitive that consumption will be restricted and the copper market smashed, as in 1907. Even if the price of copper should get so high that a readjustment became necessary, everything points to the resultant slump being of short duration. The reason for this is that the increase in consumption was held pretty steady at 10% per annum in recent years and it is likely to continue at fully this rate in the future. It is going to be much more difficult in the future to increase production 10% annually than it has been in the past, consequently, though unfortunate fluctuations may occur, the price of copper is likely to average higher in the future than in the past.

Mexico.—Developments during the last few weeks have been more encouraging and it now looks as if Madero would be able to suppress the rebellion and restore the country to a condition where business can be safely conducted. The rigid enforcement of the law passed last winter enabling the President to prevent the exportation of arms and ammunition out of the United States has had the effect of crippling Orozco and the revolutionists in the north. They are now disorganized and lacking in the wherewithal to conduct a cam-

paign, so that it is to be hoped that in the near future Chihuahua and the other northern states will be sufficiently pacified to justify the Federal troops turning their attention to the disturbed condition in the south, where the disturbance can hardly be dignified by the title of revolution. If a vigorous campaign is instituted resulting in summary justice being dispensed to a number of leaders, the moral effect on all aspirants to a life of brigandage will be excellent.

During the first four months of 1912 Utah Copper produced 34,070,000 pounds of copper, and during most of this time the company

dend of 30c. only. The Consolidated has outstanding 3,559,148 shares, the balance of the 5,000,000 having been cancelled. On this outstanding amount two 10c. dividends, three 30c. dividends, and ten 50c. dividends were paid, making total dividends of \$21,703,578 since October 25, 1907. The 16th dividend of 30c. per share declared on June 1, makes a grand total of \$22,770,578. The most interesting development in the recent history of Goldfield is the discovery, a few weeks ago, of what is reported to be a large body of ore on the 1300-ft. level from the Grizzly Bear shaft. This ore is not high-grade, but never-



NATIVIDAD MILL, OAXACA, MEXICO.

worked under remarkably bad weather conditions so that it is probable they will break all records for output during the next months. The tenth section of the Arthur mill is now completed and it is expected that the entire plant will be completed by the first of July.

Favourable reports come from the Arizona 'porphyry' coppers. The mills are being rushed to completion and both Chino and Ray are now reported to be making a 70% recovery. Chino during the first quarter of 1912 with but two of the five sections of its mill in operation produced 3,271,980 lb. at a net cost of 7.68c. per pound.

At their last meeting the Goldfield Consolidated directors dropped the extra dividend of 20c. per share and declared the regular divi-

theless has promise of being extensive and may mean a prolonged life for the company.

SAN FRANCISCO.

Petroleum production in California is running about 7,200,000 bbl. per month and the amount in storage equals about 44,000,000 bbl. There have been no notable extensions of the field or great changes in production recently, although early in June the Associated Oil Co. brought in a well near Bakersfield yielding 2000 bbl. per day. Big wells continue to be found but there is not that sweep of new things that characterized the field two years ago and even last year. Matters have settled for the present into routine, and gushers have become so common as to create little

excitement. To assume, however, that the apparent quietness indicates a falling off, is a mistake. California has got down to business, but it is a very good business. There are fewer new companies but more dividends. In May the local companies distributed \$621,000 and Mexican Petroleum, locally controlled, added \$400,000 to the total. Of the latter, \$80,000 was the regular monthly dividend on the preferred, and \$320,000 the first quarterly on the common, stock. California Oil Fields, Ltd., continues to do well despite decreased output. It is now producing about 3,500,000 bbl. per month and made a profit of \$701,915 in 1911.

That the day of new things has not entirely closed is indicated by the rapid rise to prominence of a young company that is in a fair way to rank in time with the Associated and the Union. This concern, known as the General Petroleum Company, controls the General Pipe Line Company of California, the Esperanza Oil Co., and other concerns that have been built up by Eugene de Sabla, John Barneson, W. P. Hammon, and their associates. This group has the support of James B. Colgate and others in New York, and of an underwriting syndicate at Boston headed by Tucker, Anthony & Co. The success these men have made in power projects on the Coast has given them a large following and they have an excellent hold in the oilfields. Approximately 12,000 acres of proved land with 43 wells are in their hands. The present restricted output is 6000 bbl. per day, but 16 new wells are being drilled and it is expected that 15,000 bbl. per day will soon be available. Large contracts for delivery have been made and a pipe-line, having a capacity of 30,000 bbl. per day, is about to be constructed from Lost Hills to Los Angeles and San Pedro. At the latter point storage for 3,000,000 bbl. is being provided. Contracts for the complete mechanical equipment for 13 pumping-stations are being let and on June 8 the water-tube boilers for all stations were bought. Crank and fly-wheel Corliss cross-compound pumping engines with specially designed all-steel pump-ends suitable for 750 lb. pressure per square inch will be used. The pipe will be plain, not rifled. Later the system is to be extended to San Francisco bay.

The Associated Oil Co. will be remembered as having been the first great oil concern in California. At a time when the Standard hesitated to invest heavily in this State, men connected with the Southern Pacific railroad laid the famous rifled pipe-line to San Fran-

cisco bay and made large contracts for the delivery of oil. The Associated has always been especially strong at Bakersfield, dominating that field, but later extending its operations elsewhere through the valley. It now controls about 150,000 acres in the oilfields. The report for 1911, recently made public, shows receipts from sales and dividends of subsidiary companies of \$20,192,995. From this there was a balance of \$1,766,246 transferred to surplus, making a total of \$5,957,617. The company has paid no dividends for five years but it is now announced that they are soon to begin. With the large holdings, excellent business, and comfortable surplus of the company, regular payments may be expected. It is interesting to note that the average cost of oil was reduced 4.6% in 1911, and that by introducing the air-lift the company has not only checked the inflow of water at Bakersfield but actually lowered the water-level.

Water is the ever present danger to the oilfields. The Kern County Oilmen's Protective Association has been formed for fighting water in the West Side fields, and will probably ask additional legislation from the State. As the matter now stands the Water Commissioner is empowered to correct defects in wells where the owner fails to do so, and collect the cost, if need be, by sale of the property. One cause of failure of this plan is that a number of the most troublesome wells are on public land, which cannot be sold, or have been already abandoned as of no value. As it is necessary to do something it has been proposed that a small production tax be levied by the State to provide funds for the work. The matter is still under advisement.

Titles continue chaotic. The United States Government has made no move either toward selling or leasing the oil-lands, and it seems hopeless to expect any positive action at Washington until the Presidential campaign is over. Opinion seems to be general that in the end a leasing system of some sort will be offered. In the meantime, no effort has been made to evict producers who entered upon lands in defiance of the original withdrawal order. A suit is, however, being fought to cancel patents upon lands granted to the Southern Pacific company as agricultural, and which it is claimed were in fact known to be oil lands at the time the company selected them. The Government put on the stand C. W. Eberlein, former head of the land-office of the railway company, and showed by documents that W. D. Cornish, then vice-president of the company, had full knowledge as to the character of the lands, and care-

fully concealed the matter from the Government. What the defence of the company will be has not yet been indicated. It should be remembered that this suit is one for cancellation because of fraud and does not touch the larger question of the force of a clause in the patents, following the general words of the grant, reserving from selection all mineral lands. The whole matter is complicated and raises many interesting points of law.

Politics is absorbing much public attention in the United States at present and seems likely to continue to do so till the end of the year. A presidential campaign is notoriously disturbing to business and this year there is

on a platform calling for thorough revision of the tariff. The conservatives, however, were able to carry through a bill much less drastic than was anticipated. In this they apparently overreached themselves, since the country, convinced that it was not an honest revision, has demanded that the work be done over. The lowest tariff that is politically possible would probably have done business less harm than the long-continued agitation; and the end is not yet. In the same way there has been no fixed policy as regards the 'trusts' and public lands, and the result is an uncertainty that paralyses all new business. The country is rich enough to experiment with almost any



A SCENE IN NEVADA.

the added factor of the greatest possible uncertainty as to the outcome. Since the differences of opinion in politics now relate to fundamentals of public policy regarding business organization, public lands, tariff, and similar subjects, it is not surprising that there is little disposition at present to take up new things. It is well understood that the ordinary business of the United States and its citizens is going forward satisfactorily. With exports amounting to 2200 million dollars and imports of 1600 millions, with good prices, and good crops, the country is on a sound basis. A careful student of conditions said recently that the reason business was not 'booming' was solely the uncertainty as to the conditions under which it would need to be conducted in the future. In 1908 a President was elected

policy and the most radical or most conservative that is within the domain of practical politics could do no great harm, whereas indefinite wavering from one to the other makes any consistent business policy futile.

Metal prices continue excellent and production is increasing, though so far not apparently at a rate above that of consumption. There is some uneasiness in regard to copper prices and a general disposition to scout the suggested '20-cent copper.' Indeed conservative students compute that at 17 cents, copper is already ahead of its normal price and that it cannot be maintained at any such figure. Lead has not responded to the advances in the other metals, mainly because it is closely controlled and the bulk of the business is done on long-time contracts. Quick-

silver, while one of the minor metals, is doing well. Prices are ruling at a satisfactory figure and producers are running at full capacity. There seems to be no manipulation now in this market. In Texas the Chisos alone is producing and it is uncertain when, if ever, the other companies will resume. The new mines in Nevada are producing well, and making satisfactory profits, but the conviction is growing that the deposits are not large. California remains as always the main producer of quicksilver.

Zinc is making money for everyone concerned. Record prices are being paid at Joplin, where, as always, the excellence of the ore allows the producer to dominate the market. The Wisconsin production is growing rapidly, amounting in 1911 to 93,963 tons of concentrate worth \$1,929,123 as compared with 65,421 tons worth \$1,505,752 two years before. In Wisconsin the deposits contain much more pyrite and marcasite than at Joplin, but a simple scheme for re-treatment of the ordinary concentrate permits the making of a 50% zinc product. This is obtained by giving the mixed zinc-iron concentrate made in ordinary wet mills a light roast, and then picking out the iron with simple magnetic machines. The practice in this field is cheap and effective. In the States farther west more expensive milling is necessary and here electrostatic as well as magnetic machines are used. Recently attention has been turned to flotation and at Butte the so-called Hyde process has been adopted. It is claimed that this is but an infringement of the processes controlled by Minerals Separation, Ltd., and a contest in the courts has been started. In the meantime, engineers connected with the Minerals Separation have been studying the ores from several mines in the Northwest, including British Columbia, and it seems certain that several plants will shortly be erected. Western Canada and the United States contain large reserves of zinc ores, and, as the demand justifies, they are sure to enter the market.

Copper mining in America is largely in the hands of huge corporations, among which the Anaconda Copper Mining Co. is one of the most important. Approximately three-quarters of the shares of this company are held by the Amalgamated Copper Co. The latter is a holding company which was organized in 1899 to dominate the copper situation but came to grief in 1901 and again in 1907. Nevertheless it has paid dividends averaging 6% on the market price of the shares ever

since its organization, and of recent years has paid 50c. per share quarterly. Amalgamated has no assets other than its shares of the Anaconda and the United Metals Selling Co., which in turn owns a 40% interest in the shares of the International Smelting & Refining Co. The Anaconda is the operating company and some years ago absorbed the Boston & Montana Con. Copper Co., Washoe Copper Co., Trenton Mining & Development Co., Red Metal Mining Co. (Butte Coalition), Butte & Boston Con. Mining Co., Parrot Silver & Copper Co., Alice Gold & Silver Mining Co., Big Blackfoot Lumber Co., Diamond Coal & Coke Co., and has bought the Colusa Parrot M. & S. Co., and the Original Consolidated M. Co. Recently the company has filed its annual statement for taxation purposes, which shows the net proceeds for the year to be \$10,525,730, as compared with \$5,096,445 during the preceding year. The increased profits have resulted from reductions in the working cost, as well as to the recent increased selling price of copper. It is now reported that the working costs of the Anaconda are 9 c. per pound. The figures given in the report mentioned are \$3'71 per ton for mining ore of an average value of \$8'86. The cost of transport to the smelters was at the rate of 0'3 c. per ton-mile, and the treatment cost \$1'67 per ton. During the year nearly \$10,000,000 was spent on machinery and supplies, and during the current year the smelting plant at Great Falls will be almost totally reconstructed.

Smelting practice at the Great Falls plant has never attracted the amount of attention it deserves, the focus of interest being on the plant at Anaconda, where the development of long blast-furnaces has given rise to much comment. At Great Falls the practice has tended in the opposite direction; wide furnaces, 84 inches across at the tuyeres, have been constructed. The use of this design has been made possible by narrowing the top of the furnace, so as to secure a throttling action of the blast at this point, and make it thoroughly permeate the smelting zone, with a resulting uniform distribution of heat, which permits of smelting campaigns of a week in length without stopping to bar-down crusts. The heat economy of this shape of furnace is greater because of the lessened radiating surface. Barring-down crusts is much easier in the long narrow furnace than in one of a more nearly square cross-section, and were it not that the more even penetration of a low-pressure blast (20 to 25 oz.) tends to prevent the formation of crusts, the resulting heat economy would

be gained at the expense of increased cost of labour. Converter practice at the Great Falls plant is even more noteworthy. At this plant pioneer work was done in the construction of large converters, which have now been developed up to 12 ft. diameter, with 26 one-inch tuyeres, using air at 11 to 12 lb. pressure

having produced nearly 13,000 tons of blister copper from matte averaging 38.9% copper, and having smelted about 10,000 tons of ore to furnish the silica for slag formation. This is the world's record in converter practice. Considering cold 'seconds' together with ore, about one ton of cold material is treated per



IN THE HEART OF THE ROCKY MOUNTAINS.

per square inch. These are lined with magnesite brick and the problem of temperature control, which is equivalent to preservation of the lining, has been so successfully solved that one shell had been in continuous operation, without relining, for 15 months (on June 9),

1-4

ton of copper produced. McDougal roasters are also pushed to maximum capacity at this plant, and handle about 60 tons per day each on 16-ft. hearths. During the current year the smelting plant will be entirely reconstructed, without ceasing operations, and the

engineers of the company have for some months been engaged in studying reverberatory smelting practice at other American plants to summarize its best features in the new plant at Great Falls.

Milling practice on the Mother Lode of California has been a synonym for rigid conservatism for many years, ever since the stamp-mill attained the maximum of its development there. Methods of management have been so peculiar that milling has been either a feast or famine; either there has been no ore, or else with an ample supply the tendency has been to get quick returns from maximum capacity rather than from maximum recovery, the former being easier of attainment. The stock method has been crushing by stamps, with amalgamation inside the battery, passing the pulp over plates, and concentration on vanners without previous classification, the tailing being in some cases run over canvas buddles or tables to make a further saving of the finest particles of the sulphides, which are usually present in the ore to the amount of about 2%. In the modern development of ore-dressing the vanner is being crowded out, its low capacity, high first cost, and high cost of maintenance militating against it. A beginning at introducing more modern methods has been made at the mill of the Original Amador, at Amador City, where spitzkasten are used for classification, followed by Deister tables, the middling being re-treated on Johnston vanners. This is only a 20-stamp mill and experimental work is correspondingly limited. If a good orebody is found in the Plymouth Consolidated, now being explored by Bewick, Moreing & Co., it is probable that a really modern mill will be constructed and a new chapter in Mother Lode milling practice started. It will be an interesting case of mutation if California practice, which has shaped the development of English mines in South Africa, is galvanized into renewed activity through English capital.

TORONTO.

Porcupine.—The 40-stamp mill of the Dome mine has for some time been in steady operation treating about 250 tons of ore daily, which quantity it is hoped to increase considerably in the immediate future. Development work is practically confined to the 100-ft. level, to which the incline is being extended. As diamond-drilling has shown the continuance of the orebody toward the Dome Extension, there is sufficient ore above the 100-ft. level to furnish a supply for some years with-

out going deeper. The Hollinger and Vipond mills are in part operation, the former running 10 stamps at a time to test the machinery and get it into working order. The Vipond, owing to the non-arrival of a motor long overdue, is only running the crusher and one ball-mill and handling a few tons of ore per day. Ten additional stamps have been ordered by the Hollinger for delivery in July, bringing the total number up to 50. The McIntyre has opened an orebody averaging 66 in. wide on the 200-ft. level. C. B. Flynn succeeds F. P. Schwindler as manager. At the North Dome, B shaft is being put down to the 100-ft. level, at which depth a cross-cut will be run north to the vein, which shows from 3 to 10 ft. of ore at the first level running \$41 to the ton. The McEneaney recently cut an orebody at the 300-ft. level in the porphyry having a width of 6 ft. with fine gold showing throughout. At the Hughes a compressor plant is being installed, and development work has been slackened until it is ready for operation, when the shaft will be sunk to 200 ft. The Dome Lake is also installing a new compressor plant. A good vein has been encountered at 48 ft. in the shaft. Active operations have been resumed at the Pearl Lake property, where No. 1 main shaft will be sunk to the 800-ft. level, stations being cut at 400 and 600 ft. The Standard has closed after spending a large amount on development. The ore-shoots were rich but not continuous, and the outlook was regarded as not sufficiently encouraging to warrant further outlay. The Mulholland, operated by the W. S. Edwards interests, has sunk to the 200-ft. level, and is cross-cutting to reach the vein, which shows well at the depth of 100 ft. Engineers from London are making a close examination of the Scottish-Ontario property on behalf of prospective buyers. Development at the 200-ft. level of the Davidson claim, owned by the Crown Chartered, has disclosed a high gold content in a lens encountered after driving 36 ft. A rise is being cut. Conditions on the second level are pronounced equal to those on the first. A new vein has been tapped in the cross-cut near the north shore of Pearl lake on the Plenaureum. The Porcupine Lake has encountered gold in the porphyry at 10 ft. in the shaft, which is being sunk to the 100-ft. level. At the Swastika the main vein has been picked up at the 400-ft. level, where it is stated to vary in width from 5 to 16 ft., showing free gold. The stamp-mill is now under construction. The main shaft of the Lucky Cross in the Swastika district is to be put down to 200

ft., exploratory work at the 100-ft. level having given satisfactory results. Pending the actual results of milling operations in the Porcupine district, speculation has been dormant and shares generally have shown a declining tendency.

Cobalt.—The value of the output of the silver mines of Cobalt and adjacent districts shows a steady increase, with larger shipments of bullion and a fall in consignments of ore. During May the Nipissing output amounted in value to \$226,140, the main source of production being vein No. 73, which yielded over \$100,000 worth of ore, principally from the 245-ft. level. Cross-cuts are being run at this level to pick up the extensions of a number of

clared a 3% dividend plus a 7% bonus. The output has increased, the management estimating the total for the first half of 1912 at 1,500,000 oz. This is due to the discovery early in the year of two new veins averaging 4 in. each in width and carrying 4000-oz. ore. Other companies which declared dividends this month were Crown Reserve 2% plus 3% bonus; Kerr Lake 5%; and Trethewey 10%. The Crown Reserve had a total surplus on hand as at May 31 of \$817,741. The Buffalo has broken ground for a metallurgical plant capable of handling the entire product of the mine, concentrate and high-grade ore. It will be modelled largely on the Nipissing process. Work has been resumed by the Pennsylvania-



DEVICE FOR MEASURING THE FLOW OF WATER.

veins. The high-grade mill treated 175 tons of ore and shipped 298,973 oz. of fine silver. The low-grade mill is being rapidly built. The regular 5% quarterly dividend with an additional 2½% bonus has been declared. This brings the total returns to shareholders to date to 144%. The Beaver's quarterly statement shows a cash balance on hand on May 31 of \$55,829. The mill has been running steadily since March 18 with a total production of the value of \$43,907, giving a net profit of \$36,895. The company has purchased the Erie Cobalt property of 40 acres for \$1500, with the object of conserving water for milling purposes. The main shaft is down to 590 ft. and cross-cutting will be done at 600 ft. The company is working in rich ore at the 400-ft. level. An interim dividend of 3% was declared. The McKinley-Darragh has de-

clared a 3% dividend plus a 7% bonus. The output has increased, the management estimating the total for the first half of 1912 at 1,500,000 oz. This is due to the discovery early in the year of two new veins averaging 4 in. each in width and carrying 4000-oz. ore. Other companies which declared dividends this month were Crown Reserve 2% plus 3% bonus; Kerr Lake 5%; and Trethewey 10%. The Crown Reserve had a total surplus on hand as at May 31 of \$817,741. The Buffalo has broken ground for a metallurgical plant capable of handling the entire product of the mine, concentrate and high-grade ore. It will be modelled largely on the Nipissing process. Work has been resumed by the Pennsylvania-

Measuring Water.—Among the technical operations at Cobalt a mention must be made of the prospecting on the big Nipissing hill by hydraulic methods. A pump with a 3-inch nozzle is used; it is fed by a 14-in. steel pipe and delivers water under a 170-lb. pressure. By this means the loose soil and overburden is rapidly removed, the rocky surface becoming exposed so as to show outcrops of the small but rich calcite veins. The water is

measured as it enters a circular tank; a bucket on a truck running on rails takes a 'sample,' as it were. The time during which the flow is thus diverted is measured by a stop-watch. The accompanying photograph shows the arrangement, which has proved convenient and accurate.

CAMBORNE.

Tin Ticketings.—Below I give a comparison of the sales of black tin at the ticketings for the three last half-years, and also the figures relating to the principal mines:

	6 months ending June 30, 1911. Tons.	6 months ending Dec. 31, 1911. Tons.	6 months ending June 30, 1912. Tons.
Quantity of black tin ticketed	3011	3140	3230
Value.....	£344,491	£358,096	£393,326
Average Price Secured.....	£114. 8. 2	£114. 4. 4	£121. 15. 3

<i>Individual Mines.</i>	Quantity Tons.	Value £	Quantity Tons.	Value £	Quantity Tons.	Value £
Dolcoath.....	849	99,622	850	98,272	793	97,304
Carn Brea & Tincroft	367	37,494	409½	45,293	485½	56,265
Grenville United	264	31,183	330½	39,122	367	46,512
South Crofty.....	344	38,981	334	37,292	316	38,825
East Pool & Agar.....	242	27,063	234½	26,525	246½	29,848
Basset Mines	305	37,661	248	30,406	216	27,953
Levant	177½	20,572	187	20,410	184	22,761

The substantial increase in the sales of Carn Brea and also Grenville will be noted with satisfaction, while it must be a matter of thankfulness to the executives of Dolcoath and Basset that in spite of the heavy drop in their sales, the higher price realized has counteracted this to a considerable extent.

National Insurance Act.—This Act, which comes into operation on July 15, is likely to prove a burden which some of the mines can ill afford to carry in spite of the existing high price of tin.

It was not thought at first that the unemployment section of the Act would apply to Cornish mines, for the object of that section was to insure men in trades, such as building, where unemployment was unduly heavy. But the interpretation placed by the authorities brings many men employed by the mines within this section of the Act, for it has been ruled that those "engaged wholly or mainly in the work of construction, alteration, repairs, decoration, or demolition of buildings" are concerned, as well as those engaged "wholly or mainly on the work of maintenance and up-keep of machinery." It will not be always an easy matter to decide when insurance is

payable on men so engaged, for often they are during part of their time doing work which would not bring them within the Act.

Nancegollan Mine.—This property at Crowan, and known by some as Polcrebo, has, I hear, been taken up by H. C. Hoover, who proposes to unwater it forthwith.

Tresavean.—E. S. King quite fills the picture of Cornish mining today, his latest appointment being the management of this mine. He is now general manager for four companies. A large sum of money has already been spent by Scottish capitalists on unwatering

this property to the bottom, and a good round sum will still have to be spent on development before returns on any large scale can be made. The mine, which was once a notable copper producer, is thought to be a good one, and if tackled with vigour and in a miner-like way, should prove a good speculation. Mr. King has associated with him as consulting mechanical engineer, R. D. Gill, who acts in a similar capacity to South Crofty and Botallack.

Mulberry.—This property, situated at Lanivet, near Bodmin, has been acquired by Bainbridge, Seymour & Co., and thus we have another firm of well known engineers interesting themselves in Cornish mining. The deposit, which is in the nature of a stockwork, has been worked intermittently from time immemorial as a quarry. The killas is traversed by numerous veins, varying from mere joints to 5 inches in width. These carry tin, wolfram, copper, and a little arsenic, but they have been chiefly worked for tin, as the other constituents are not in sufficient quantities to extract independently. An adit has intersected the tin-bearing strata at right angles, and drifts have been made north and south for the whole length of the quarry. The ore is blasted down

to the chutes above the adit, and then loaded into cars which gravitate to the mill, the empty cars being returned by means of a wire rope worked by a motor.

Geevor & North Levant.—This property is situated at Pendeen and adjoins the famous Levant and Botallack mines. The mine has been worked spasmodically over a long period, but a few years ago it was taken in hand by some miners, and subsequently acquired by Oliver Wethered and his friends. The lodes are narrow but often rich, like those in the neighbouring properties, and the latest reports

though a portion of the sand remains for subsequent treatment. It is now reported that recent developments justify more than doubling the capacity of the present mill and that the necessary steps are being taken forthwith to this end. R. Gilman Brown is on the directorate.

Dolcoath.—There has been a substantial improvement recently in the 490-fm. level west of Williams shaft, the lode for the last six months having produced 60 lb. of black tin per ton for the full width of the drift, which is six feet. This end is being driven into a



DOLCOATH.

show that profitable ground is being developed. The main shaft is down 100 fathoms, and will be continued a further 25 fathoms, while development on the various lodes is being vigorously prosecuted. The mine is equipped with

large area of unexplored ground that could be cheaply and expeditiously worked, so that the continuation of this enrichment is a matter of some importance to the shareholders, and the increase in the price of the shares by

RESULTS AT DOLCOATH.

	Six months ending June 30, 1911.	Six months ending Dec. 31, 1911.	Six months ending June 30, 1912.
Tons Crushed	40,315	46,343	48,566
Black tin sold (tons).....	853	853	796
Average recovery (lb. per ton)....	47'38	41'23	36'7
Value of black tin sold	£100,048	£98,648	£97,730
Average price per ton.....	£117'3	£115'6	£122'7

two Holman air-cushion stamps, and necessary dressing plant, and has been returning about 11 tons of black tin per fortnight, a recovery of only about 22 lb. per ton milled, al-

5s., to 24s., reflects the opinion of local people. The 412-fm. west of the Old Sump shaft has also improved, showing for the last thirty feet, 50 lb. black tin for the width of the drift.

Prospects of a Revival.—To those who have been for many years directing attention to the West of England as a field for mining enterprise, it must be a source of satisfaction to find that recently so many properties have been taken up by people who have some knowledge of mining matters. I have already drawn attention to the number of prominent firms of engineers who are interesting themselves in Cornwall, such as John Taylor & Sons, Bainbridge, Seymour & Co., H. C. Hoover, and this is a most hopeful feature.

KALGOORLIE.

Labour Troubles.—The spirit of unrest is still evident. In quick succession the engineers and moulders at Kalgoorlie went "into conference," and the latter called out the half-dozen moulders employed on the Sons of Gwalia, at Leonora, and on the Lancefield at Beria. After losing 8 weeks wages these men returned to work on the same conditions as before, namely, from £5 to £5 10s. per week, the highest wages on the goldfields. The Lancefield, however, closed down, and some 450 men lost their work through the folly of three. The mine itself never looked better, but the plant, which cost £60,000 to erect in 1906, and had to be re-modelled in 1909 at a further cost of £50,000, was so badly designed and erected that it has been a complete failure, and another £50,000 or £60,000 will have to be raised before treatment can be resumed. The mine has produced £830,000 from 540,000 tons, or 30s. 9d. per ton, but this has barely met expenses owing to treatment costs alone swallowing up 17s. 6d., and mining and development bringing up the total to 31s. 6d. per ton. More recently the shovellers at Yu-anmi dropped their tools, but returned to work at an advance of 8d. per shift, to hold good for a period of three years.

The Industrial Agreements with all the workers in Kalgoorlie will expire on September 30, and a month's notice on either side has to be given. The Unions are already considering the question. The shovellers and mullockers are the only class of labourers really dissatisfied, and no increase of wages likely to be offered will prevent the vast majority leaving the mines to work on the trans-continental railway. Their places will have to be filled by Austrians and Italians, who will work anywhere and under conditions to which Britishers will not consent.

Geology.—The late Government, when in office, appointed a number of budding geologists to report on the various goldfields of the

State, and we have had inflicted on us high-flown dissertations on the geology of mines that have already given up their gold, and whose flooded and abandoned workings have no interest for anyone. What the Kalgoorlie Chamber of Mines advocated was to get geologists to point out to prospectors where they were likely to find the lost continuations of lodes, and especially what had become of the lodes in blanks between two gold centres. Instead of this we are inundated with columns of high falutin verbiage on mines at Coolgardie, Kanowna, and other centres abandoned a dozen years ago. There appears to be no live geologist of the type required to put fresh life into West Australian mining. Dr. Malcolm MacLaren was in this State for about a year, but so far as anyone knows he might just as well have stayed away. The only advice he was known to express was for the North Kalgurli to continue their present system of tributing. This mine has 10 levels down to 1000 ft., and is connected with the Kalgurli and Brookman's Boulder workings at 1000 ft. During the last six years tributers have won £118,000 from 61,400 tons and paid £18,000 in royalties, but the bulk of the ore is coming from old stopes, and this is merely depleting the mine. On the neighbouring Paringa and Oroya, tributers started from the surface and made entirely fresh discoveries. Men who can do this should be encouraged by every company holding large unprospected areas, such as the Oroya-Links, and Associated.

[Mr. Maclaren's report was made, not for the State, but for private parties. It was a remarkably good diagnosis of local conditions and afforded a valuable guide to the persons who paid for it.—EDITOR].

Ivanhoe.—R. B. Nicolson, manager of the Ivanhoe, is now on his way to London to consult the directors. The poor developments on the east lode south of the shaft at 2270 ft. and 2420 ft., and the falling off in the grade of the ore coming from the stopes, induced Mr. Nicolson to reduce profits to £16,000 a month, which means dividends of 19s. per share. The lode at 2570 ft. has not yet been cut, as it is about 330 ft. east of the shaft. The main shaft is over 2600 ft. deep, and is being slowly but steadily deepened. A bore-hole put in from the Great Boulder at 2800 ft. pierced a lode, at 57 ft. from south and 12 ft. from the east boundary, assaying 89s. 6d. per ton. This proves that good ore persists, and that the present workings are in a poor zone. Developments in the adjoining Horse-Shoe mine confirm this inference.

DISCUSSION

Our readers are invited to criticize anything appearing in this magazine and to discuss other subjects of general technical interest.

Discovery of Tellurides at Kalgoorlie. The Editor:

Sir—It is strange that after the lapse of only sixteen years there should now be a conflict of opinion not only with regard to the events that led up to the discovery of the gold-tellurides of Kalgoorlie in Western Australia, but even with regard to the identity of the discoverers. It was an event of prime importance to the Australian mining industry, and one that has also exercised a profound influence, both direct and indirect, on metallurgical practice in the treatment of gold ores, yet today at Kalgoorlie itself it is impossible to obtain, even from men who were in the forefront of mining in 1896, accounts that do not conflict at vital points. In the last issue of *The Mining Magazine* a writer, clearly reminiscent of personal experiences and otherwise accurate, misstates both the name of the discoverer and the place of discovery. While engaged on a geological survey of the Kalgoorlie field some three years ago I became interested in the matter and with some trouble the following sequence of events was pieced together; it is believed to present as close an approximation to the truth as is possible at the present day.

Gold-telluride was first recognized from the No. 2 level of the Block 45 lease, now included in the ground of the Oroya Links, Ltd. The then manager, Richard Eades, had obtained high assays from apparently pyritous samples that showed little or no free gold. Repeated tests convinced him that the gold was associated with a soft, pale-bronze mineral, and samples were therefore sent to various Coolgardie and Kalgoorlie assayers. Eades indicated the mineral carrying the gold and asked for a determination of its nature. A hazy suggestion of one of the iron sulphides was the only result, but the extreme softness of the unknown mineral at once showed that this suggestion was incorrect. Specimens of the find were naturally given to those interested in the fortunes of the mine, and among others, to Bob Gibson and Allan Davidson. The former took samples to his camp on Maritana hill and on the afternoon of Sunday, May 24, 1896, in the presence of Davidson, showed them to Erle Huntley as typical of the rich 'sulphides' of the Block 45 mine. Huntley had had some previous experience of telluride ores at the Mt. Shamrock mine in the

Mt. Burnett district, Queensland (where gold is associated with the tellurides of silver, bismuth, and selenium), and suggested that the new mineral might be a telluride of gold. This mineral species was unknown to the others present, and indeed its very existence was scouted, but the question was speedily settled by reference to a 'Dana' lying handy. Huntley took away fragments of the mineral, and on the following day made blowpipe tests on them in A. J. McGeorge's laboratory, fully confirming the accuracy of his suggestion to Gibson and Davidson as to the nature of the mineral. That evening in the course of conversation he communicated the news of his discovery to Davidson and to Peter MacIntyre, the latter then representing the company owning the rights to the cyanide patents in Australia.

On Wednesday, May 27, Eades forwarded two samples of the ore to A. G. Holroyd of Holroyd & Tinley, assayers. These samples yielded respectively 31 oz. 10 dwt. and 92 oz. 7 dwt. gold per ton. Following his usual custom Holroyd panned some of the crushed ore and was immediately struck by the discrepancy between the high assay-value of the original samples and the meagre show of free gold in the pan. The first sample indeed showed no free gold, and the second only 2 oz. 7 dwt. per ton of ore. The 'pyritous' ore obviously contained nearly all the gold. There was then at Kalgoorlie, as in most new mining camps, a free and extensive exchange of ideas among members of the same professions, and Holroyd showed the ore, and the pan-concentrate therefrom, to Peter MacIntyre, who informed him that Huntley's tests, already made three days before, had shown that the mineral was telluride of gold. Tellurides of gold were then almost unknown minerals to the Australian miner, although the great richness of the Cripple Creek mines had indicated their importance; there was naturally therefore some haziness concerning the tests for tellurides. MacIntyre was not himself at that time conversant with them, but lent his 'Fresenius' to Holroyd, and further assisted Holroyd in the chemical examination of the mineral. The existence of tellurides of gold was soon proved both by dry and by wet methods. On Friday, May 29, Holroyd communicated the news of the discovery to the Press, probably to the *Coolgardie Miner* (files of which have not been accessible), for the first reference to the matter in the *Kalgoorlie Miner* is in the issue of June 1. Holroyd's connection with the discovery has been fully

outlined,* for at a later date he made claim to the credit of the discovery, and indeed to him it is usually ascribed. To him is certainly due its first publication, but it is noteworthy that in the same article that announced the finding of telluride of gold at Kalgoorlie it is definitely stated that priority of discovery was claimed by Mr. Hunter (*sic*), and no contradiction of this statement was made by Holroyd or by others at the time in the local Press.

Meanwhile Erle Huntley and A. J. McGeorge had been making further investigations and on June 2 they published the first complete analysis of a Kalgoorlie telluride of gold.

Gold.....	42'6	Iron.....	0'9
Tellurium 54'1		Arsenic...	1'1
Silver.....	0'7	Sulphur...	0'4 = 99'8

The iron, arsenic, and sulphur were obviously due to a fragment of mispickel that had not been separated from the calaverite.

Before the publication of the discovery, Huntley and MacIntyre had discussed it in all its bearings, and naturally saw in it the solution of the problem that for three years had puzzled mining men at Kalgoorlie, namely, the origin of the rich and unique deposits of 'sponge' and 'mustard' gold so characteristic of the oxidized zone of the Boulder mines.

On June 1 the Block 45 lease was thronged with assayers and others in quest of specimens of the new mineral and a vigorous search for it was commenced at other mines. On June 4 J. Collet Moulden obtained telluride ore from the dumps of the Cræsus mine, where it had been lying for months. It assayed 13 oz. 15 dwt. A few days later Holroyd found rich telluride ore at the Australia mine (Associated Gold Mines) where it had been cut in the shaft at a depth of 90 feet, but, having been mistaken for pyrite it had been thrown over the dump, whence blocks of ore, assaying more than 500 oz. gold per ton had been utilized to build a rough hearth and chimney in a miner's hut! Within a few months gold-tellurides had been found at the Great Boulder, Hannan's Star, Lake View Consols, Golden Horseshoe, and Kalgurli mines. The Ivanhoe, South Kalgurli, Brownhill, and Oroya were the last of the important Kalgoorlie mines to pass down into the sulphide zone and find telluride ore.

On November 13, 1896, nearly six months after the original discovery, gold telluride was obtained at a depth of 140 ft. in the Great Boulder Main Reef mine, then under the management of Modest Maryanski, a German mining engineer, who was immediately hailed

by the German technical and scientific press as the discoverer of Kalgoorlie tellurides. Throughout the laudatory notices in these journals* there sounds a note of self-congratulation since it was clearly by virtue of his thorough German training that this engineer had recognized a mineral that had escaped the notice of the British engineers, and furthermore since it had been made at a most auspicious moment, just in time to prevent the contemplated withdrawal of English capital from the West Australian mining industry.

According to local gossip, this find nearly brought about the annihilation of the 'discoverer' at the hands of the stalwart Cornish shift-boss reporting the matter, the latter being too astounded to immediately resent the osculatory demonstrations of gratitude and excitement with which he was overwhelmed.

From the foregoing it will be apparent that while the chief credit is undoubtedly due to Huntley, minor parts in the recognition of the gold tellurides of Kalgoorlie were borne by Eades, MacIntyre, Holroyd, and McGeorge.

MALCOLM MACLAREN.

London, June 22.

Travel to Northern Nigeria.

The Editor :

Sir—The following notes may prove timely. An engineer going to the tin region in Northern Nigeria has the choice of two main routes : one by Lagos and thence by railway to Rahama ; the other by Forcados, up the river Niger to Baro, and then by railway to Rahama, or diverge from the Niger, up the river Benue, to Loko, and then 'trek.' Our mail boat arrived off Lagos on the 16th day after leaving Liverpool. At present landing is conducted under difficulties, as passengers and baggage have to be transferred by means of surf-boats to a local steamer of about 1000 tons, because boats drawing more than 14 ft. of water cannot cross the bar. Two years hence the authorities expect to have two breakwaters finished and a channel dredged deep enough to permit boats drawing 25 ft. of water to enter the harbour. All cargo for Lagos is carried on to Forcados, where it is transhipped to a local boat and sent back again ; this means 5 days extra at the least. Forcados is situated at the mouth of the Niger and from there or at Burotu, a few miles farther cargo and

* "Bergingenieur Modest Maryanski in Great Boulder Main Reef bei Kalgoorlie eine Entdeckung gemacht, die für die Bergwerksindustrie der australischen Kolonie von der grössten Bedeutung ist . . . Der Entdecker, von dessen Namen augenblicklich alle australischen Zeitungen voll sind, hat . . ." etc. *Zeitschrift für praktische Geologie*, Feb. 1897, p. 72.

* Trans. Aust. Inst. M.E., Vol. IV., 1896, p. 186.

passengers are transhipped without the inconvenience of surf-boats to the river-boats and steamers. During the wet season, from June to February, deep river-boats carrying two or three hundred tons can get up to Baro; from July to October steamers with a tonnage of 1000 can also get up to the same place. In the dry season river traffic is carried on under difficulties and about 100 tons of cargo is the limit that the boats take. For mining men and visitors the Lagos route is both preferable and quicker, but anyone taking out say 6 months' supply of provisions, will find it preferable to go by way of Forcados, on account of expense. Of course it is possible to go by Lagos oneself and send the provisions by Forcados, as was done in my case, but as goods unaccompanied by their owner are apt to reach their destination any time from 2 to 4 months later, it seems a good plan to arrange for 'chop,' or food. Practically all mining supplies and machinery go by Forcados at present, and they take time to reach their destination. If anything is wanted in a hurry from England (you can get next to nothing in the field) it would pay every time to have the goods shipped by Lagos and a man sent down to meet them at the port. Worry the necessary officials and they will do their best to get rid of you.

When the local steamer moves alongside the wharf at Lagos, the experienced traveller takes care that all his things remain on board, as the railway does not start from Lagos proper, which is on an island, but from Iddo, on the mainland, which is only about a hundred yards across the water, but two miles by way of the only bridge. A boat train is run in connection with the mail-boat and a charge of 30s., over and above the first-class fare, is made for the privilege of travelling on it. One wonders why it is called a *train de luxe*, even though a restaurant car is attached. The fare to Rahama is just over £10 and freight is 14s. per cwt. The train leaves Iddo at 9 o'clock at night, and after the first night only moves during the day. At the end of the second day Minna, which is the junction of the Baro and Kano line, is reached. Passengers leave the boat-train for one composed of luggage-vans, and they soon cease to wonder why the former is called the *train de luxe*. Zaria, which is the junction of the Rahama narrow-gauge branch, is reached on the morning of the fourth day, and one leaves it again at 8 o'clock the next morning for Rahama, which is reached the same night.

Rahama is the present railhead. It has a

store with very little in it, and two rest-houses for travellers. In one of the rest-houses I came across a party of mining men who had already been waiting 10 days for a part of their equipment. At Baro an official informed them that it was not necessary to make their



A Market Stall.

carriage uncomfortable by stacking all their luggage in it; if they liked, he would send it on by another train, and they would find it waiting for them at their journey's end. By the time they got their equipment they were angry and wiser men. Generally it is necessary to wait a day or two to collect carriers; then 'treking' commences; eventually the mine will be reached after losing the way a few times.

W. RYAN LEWIS.

London, June 20.

Concentration v. Cyanidation.

The Editor:

Sir—My thanks are due to Mr. G. A. Denny for the trouble he has taken and the length to which he has gone in replying to my contribution to the discussion on the above subject.

Mr. Denny alludes, at the outset, to the "habit of considering assay-values in terms of metal, and the cost of production in terms of money" as a grievous error. In this I cannot agree with him. To consider a loss as an item of treatment-cost is, to my mind, neither logical nor exact; and I should consider such a method of statement more open to question than the one which Mr. Denny so unhesitatingly condemns. The money-value of a treatment-loss added to the actual costs would result in a figure of considerable significance and value for comparative purposes, but I can see

no error in the alternative method of statement.

Mr. Denny is pleased to suppose that I ignored the question of extraction in presenting what figures I did on the subject. In this respect he is wide of the mark. I summarized by saying that "the difference in favour of single treatment is about 9½d. per ton, together with a slightly higher extraction of values." This covers all points that should be considered in the question of a comparison of treatment methods.

As regards extraction results Mr. Denny finds considerable fault with my figures. Given a 90% extraction with a 30 oz. head I estimated an 88% extraction with a 24 oz. head, based on actual experience. Mr. Denny would expect a 95% extraction and gives as his reason the removal of the "rebellious elements." These rebellious elements here occur for the first time and as we have no definite knowledge as to their nature or distribution it is impossible to argue the advantage or disadvantage of any particular scheme of treatment. A concentrate need not necessarily be rebellious and I was careful to preface my remarks on the subject by the statement that the comparison referred only to cases "where treatment of the whole by cyanide is not adversely affected by the presence of the concentrate." I am, of course, in entire agreement with Mr. Denny as to the advisability of shipping rebellious concentrate to the smelter.

On the question of the cost of treatment, Mr. Denny expresses surprise that I should have entirely overlooked the increased charges to be considered in dealing with the unconcentrated ore. The rebellious elements are again referred to and items are totalled which, in Mr. Denny's opinion, would make the cost of treatment 5s. 2d., instead of the 4s. 6d. per ton that I mentioned. In reply to this I may say that I had no option but to take the figure given by Mr. Denny himself as the approximate treatment-cost in the direct cyanidation of the silver ore under discussion. This figure—4s. 6d. per ton—is given on page 434, line 21, in the December issue. The recovery per ton is given as 27 oz. fine; and I presumed that the original value of the ore was 30 oz., and not 20 oz. as stated.

On the question of refining cost I still adhere to my original contention, namely, that in the December issue the amount under this heading should have been 2s. and not 2s. 3d. per ton. The refining cost was given as 0'89d. per fine ounce. The "total fine silver produced from 1 ton of ore, 27 oz." The refining cost per ton is therefore 0'89d. multiplied by

27, and this amounts to 24'03d., or 2s. In the April issue it is to be noted that, on a comparison with the figures given in the December issue, the refining cost has risen over 10%, and also that the same grade of bullion is produced with or without the rebellious concentrate in the ore. The extraction for all-cyanidation is now given as 89'2% instead of 90%; and the cost of treatment has been re-adjusted from 4s. 6d. to 5s. 2d. per ton. With these alterations Mr. Denny exhibits an entire lack of confidence in his original estimates; and while he is at liberty to strengthen his argument by an alternative method of statement he will understand that only so long as he adheres to his original figures will any discussion upon them be possible.

Mr. Denny concludes with a platitudinous outburst in which he warns the readers of the magazine not to confound metal-values with money-values, "as Mr. Allen has done," whereas in the earlier part of his letter I am accused of participation in the general habit of keeping them strictly apart. On the Rand, we are told, the extraction should be reported as 71%, and not 87%, the residue value forming part of the 'cost.' Twenty-two shillings, for example, is 'recovered' at a 'cost' of 9s. (5s. treatment and 4s. residue). When the dumps are re-treated I presume that the residue-value will be resuscitated into an asset, part of which will be again charged out as another 'cost.' The total 'cost' of both treatments will then be quite in error as certain items will have been charged in duplicate; and it will then be seen that the original cost of treatment will only be correct when it does *not* include the money-value of the original residue. The exceptions are indeed few where the valuable contents of the residue-dump can be disposed of as an expenditure in the cost-sheet of a return with that air of finality which characterizes Mr. Denny's proposal.

A. W. ALLEN.

The Lonely Reef Mine, Rhodesia,

May 19, 1912.

Costs in Nigeria.

The Editor:

Sir—Under the heading 'Costs in Nigeria' in your April issue, I notice that you divide a year's output of black tin won from the Narguta mine by the number of cubic yards treated during the same period. I beg to point out that a large proportion of the output from that mine is derived from calabashing in the beds of the streams, in which operation no account can be taken of the volume of wash

treated. You will therefore see that the above calculation will give an exaggerated value to the ground treated.

For the same reason the total expenditure must not be charged against the number of cubic yards treated, since a part of that total will have been expended on calabashing. The figure which you quote, 4s. 5d. per yard, is more than double the working cost which ruled during the time when I was in charge of Naraguta (1908-9), though labourers' wages stood at the same figure as at present.

HOWARD JOHNSON.

Naraguta, Nigeria, June 6.

Cornish Tin Ticketing.

The Editor:

Sir—In support of the interesting statistics on Cornish tin ticketing sent by Mr. Harold E. Fern, published in your May number, I send you some figures giving the result of sales of tin concentrate from the King Edward mine of the School of Metalliferous Mining.

The figures are the average of eight small parcels sold during 1911 and 1912 and are placed for easy comparison in parallel columns with the figures for Wheal Kitty & Penhalls.

	King Edward	Wheal Kitty
Smelter's ton. Wet lb.	2300	2300
Moisture. Per cent.	9.1	6.9
Dry weight. lb.	2093	2141
Percentage Sn.	69.9	71.5
Do. Cu.	0.7	—
Tin in Smelter's ton. lb.	1462	1531
Price paid by Smelter.	£113.57	£114
London price of tin, per 2240 lb.* ..	£195	£187
Smelter's price for tin, per 2240 lb.	£173.25	£166.8
Percentage of London price paid for Value of tin in ton of concentrate at London price.	88.8	89.2
Difference between London value and Smelter's price per ton of concentrate.	£127.7	£127.8
	£14.13	£13.8

* King Edward, value on day of ticketing. Wheal Kitty, value at 3 months' prices.

It will be noticed that the value received per lb. of metal sold at both mines is very close, in round figures 89% of the London value.

In discussing the prices offered, Mr. Fern has not called attention to the important factor of the presence of impurities in the concentrates. The presence of copper, for example, has an important influence on the price.

The methods of sale are antiquated, but they have the advantage of eliminating any chance of dispute over assays. Both sides know what they are doing. The seller knows his moisture and tin and copper contents, and it makes no difference whether the buyer offers him a price

for 2300 lb. of concentrate wet, or for 2000 or 2240 lb. of dry ore, or for so much per cent of metal per ton. What interests him is the price he receives for the metal contents as compared with the market price.

I may add that the assays of the concentrate were made by the wet method, as is the case with all our mine and mill samples.

Many of the mines still keep their records on vanning assays, which being on an average about 30% short of the true value give comforting extractions. If the mines kept their statistics on the wet or true assay, the serious losses in tin dressing—probably 40% on an average—going on throughout Cornwall, would attract more attention than they do.

W. FISCHER WILKINSON.

Camborne, July 1, 1912.

Zinc in the United States.

The position of zinc in the United States continues to attract the close attention of producers, consumers, and engineers. The market is entirely independent of that of the rest of the world. During the last year, American prices have steadily advanced owing to the production not keeping pace with the demand. The first cause for this was the exhaustion of the natural gas wells of Kansas and Oklahoma, and the consequent necessity of transferring works to Illinois and other places where coal or oil is cheap. A second cause is the temporary halt in the yield of high-class ore. The Kansas and Missouri zinc district is not expanding, and is in fact beginning to fall away, though the Oklahoma and Wisconsin districts are increasing their output. Attention is also being devoted to lower-grade and more complex ores, and from this point of view we may mention that the exploitation of such ore deposits has been in abeyance owing to the richness of the Joplin and other districts. In this way the beneficiation of zinc ores in America is behind the practice in Europe and Australia, where the art of utilizing unpromising ores has had to be more closely studied. Mines and districts not hitherto identified with zinc will be producers before long. The Butte & Superior in Montana is coming forward, and Anaconda will possibly follow suit. There is every probability that the Butte district will be an important source of zinc within a few years. In the meantime the supply of metal is short, and the price is advancing. The present New York quotation is 6½ c. per lb., or £31 per long ton. The import duty is 1.37 c. per lb., and a further rise of ½ c. per lb. would make imports possible.

ALLUVIAL MINING ON GOSS MOOR, CORNWALL

By J. E. MACNAMARA and H. E. FERN.

ALLUVIAL mining in the West of England was once an important industry, but, judged commercially, the deposits generally were thought to be exhausted, until J. H. Collins commenced operations on a small scale on the Goss and Tregoss moors in 1908. Since then, operations have been started in other parts of the county, notably at Red Moor and Breney Moor.

The Goss and Tregoss moors are situated between St. Dennis and Roche in central Cornwall at a height of 400 to 500 ft. above sea-level. They form a basin, surrounded by hills of granite, and the river Fal has its source from within its borders. The moors are readily accessible, the Newquay branch of the Great Western railway running along the northern boundary.

Indications of former tin stream-works are to be found here and there, but it seems evident that no attempt has ever been made, until recently, to work the moors on a large scale. Small portions have been worked out by the old-timers, but the difficulty of draining the ground with the primitive appliances then in vogue prevented anything but spasmodic operations. No doubt too the difficulty of getting a regular and adequate water-supply without a considerable expenditure of capital made the work unremunerative, and thus brought these small operations to an end.

VERTICAL SECTION OF NEW GROUND.

	Ft.
Surface Soil.....	1
Clay	3
Peat	3
Loose Wash and Drift carrying Fine Tin.....	8
Tight Heavy Wash carrying Coarse Tin.....	5
Clay Bottom.....	Unexplored

The alluvial ground is usually covered with alternating layers of peat, sand, and gravel, capped by earth or bog. The tin ground itself varies in thickness and quality, resting on an irregular 'shelf' or false bottom of clay. The best returns are usually obtained from the three feet of wash resting on this shelf, but the whole face of the ground carries a little tin. In some parts of the moor the tin is very fine, while coarse-grained tin is found at other

parts. Where the coarse tin is found, water-worn stones are frequent, containing as much as 1 lb. black tin per cubic yard of gravel. The depth of ground to the false bottom averages about 20 ft., so far as it has been tested by the present company, but in one pit sunk by Mr. Collins to nearly 80 ft., tin-bearing ground was found below this false bottom.

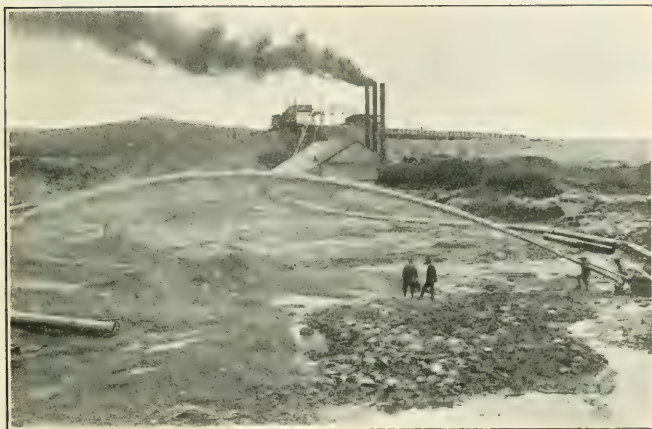
The ground already worked by the present company is of a patchy nature through being off the run of the coarse tin, but it is anticipated from the evidence of bore-holes, and from work done, that the alluvium generally will average not less than one pound of black tin per cubic yard, worth 10½d. when metallic tin is quoted at £160 per ton. Not less than 250 bore-holes have been put down, so that from that point of view the ground has been well tested.

The tinstone is of first-class quality and assays from 73 to 75% metallic tin; consequently a price is obtained well above the general average secured for lode tin by the mines of the county.

It is hoped during the dredging operations to uncover tin veins, for traces of the main lodes of the district are frequent on the moors. In fact, one of the trenches made by Mr. Collins in the early testing operations did intersect a tin-bearing lode, but insufficient work was done on it to prove its value. The present company during the course of its operations has found large quantities of tin-stones which have probably been shed from these veins, and these stones are now being stamped with good results. They are considered by the management as an important asset for the company.

A suction-gas plant, built by Crossley Bros., was installed in the first instance, but it was found that this form of power was not suitable, the main reason being that the load on the engines could not be conveniently and quickly varied. It is a matter of first importance in this class of work that the power used shall be of such a character as to be readily adjusted, within the space of half a minute, from a full load down to nothing and the reverse. For this condition of things suction-gas was tried and found lacking.

The present steam plant was designed by F. M. Lush, of the firm of C. G. Lush & Sons,



GENERAL VIEW OF THE GOSS MOOR PLANT.



GATHERING THE TINSONE COLLECTED IN THE SLUICE-BOXES.

and was made by Marshalls of Gainsborough. It consists of two compound condensing engines of 210 B.H.P. for each engine, one driving the centrifugal water-pump and the other driving the centrifugal gravel-pump. There are also three multitubular boilers worked at 150-lb. pressure, the weight of each boiler being 18 tons. A surface condenser has also been installed. The whole plant has been erected on a wooden pontoon, 50 ft. by 41 ft., and 6 ft. deep. Both pumps are of Australian pattern, made by Thompson & Co., in Victoria.

The design of pump used to elevate the gravel into the sluice-boxes is shown in the accompanying illustration. It is capable of raising 75 cubic yards of solid material, which is equal to about 90 tons per hour, to a height of 100 ft., combined suction and delivery, and of dealing with gravel up to 11 inches in diameter. A short description of the pump will be of interest. It is of the centrifugal type, specially designed for raising the gravel of an alluvial mine, and fitted with special renewable liners of cast-steel to all wearing parts. A door on the suction side gives easy access to the runner. This runner or impeller, is made of best crucible steel, and fitted with renewable shoes of manganese steel. The bearing next to the runner is made of the adjustable four-part type and fitted with a water-sealed chamber, which has a supply of clean water, under a pressure of from 40 to 50 lb. per sq. in., always coupled to it, to prevent any sand or grit working back into the bearing. The end of the shaft is fitted with a patent roller-bearing for taking up all the thrust.

The nozzle-pump, of 14 in. diam., is supplying water through 14-in. pipes to a monitor attached to the end of the pipe. The size of bit on the monitor varies, but the one generally in use at Goss Moor is a 4-inch, in which there is a pressure of 40 lb. per sq. in. A new nozzle-pump is shortly to be installed; this will give 50 lb. pressure on a 4½-inch bit. Thus the capacity of the plant will be considerably increased.

The method of working is as follows: The banks of the alluvial deposit are broken down by the force of the water issuing from the monitor, the water carrying all the dirt and stones down a race into a sump-hole, where it is elevated by the gravel-pump into sluice-boxes. The present lift from the bottom of the sump to the head of the sluice-boxes at Goss Moor is equal to 60 ft. vertical. The overburden is first treated by the monitor and then the bottom wash is cleaned off the bed-

rock or false bottom, the idea being to shift all the poorer ground before dealing with the richest tin-bearing wash. The work is performed in three shifts, the whole plant being electrically lighted at night.

The wash is first put through a 1½-in. grizzly at the head of the sluice-box, to remove all stones above that size. These stones are selected and those sufficiently rich in tin are subsequently crushed in a 14-stamp Cornish battery, which is worked by a portable engine. The sluice-boxes in use are 150 ft. long by 12 ft. wide by 3 ft. deep. The grade varies according to the material being treated. When only fine tin is passing through them, the grade is made less, and the width of the sluice-box is increased. At Goss Moor the grade is 12 inches in 24 feet. The tin is arrested by means of wooden cross-riffles placed at intervals of 12 feet. After a month's run, the tin is found deposited in layers all down the boxes. Sometimes it is found necessary to put in these riffles or 'stoppers' once in every 24 hours. They are made of pine, and are 12 ft. long, by 1½ inches wide, and 1½ inches deep. It has been found that 90% of the tin is caught in the first 80 ft. of the sluice-box, the fine tin only being arrested in the remaining 70 ft. When the sluice-boxes are full, 12 men are engaged with shovels to clear them out, starting at the bottom end, while the sand is allowed to run away. The tinstone at this stage is about a 50% concentrate. It is then taken to the store-house, and put through a small streaming-box, 16 ft. by 2 ft. by 2 ft. 6 in., and more sand is removed. This treatment improves the concentrate to 65%. It is subsequently treated in a Willoughby machine, designed by F. M. Lush, and brought up to a 73 or 75% concentrate. This machine will clean about 2 tons in 8 hours.

Every four or five months it becomes necessary to move the pontoon; this is done by filling the excavation with sufficient water to float the pontoon to its new site, which may be five chains away. When the pontoon reaches its new position the water is pumped out of the excavation by means of the machinery on board and thus it is soon resting on bedrock ready for more work. This change of position, coupled with the necessary preparations, is effected in about 10 days, provided there is no wait for water.

So far the cost of treatment at Goss Moor has been rather on the heavy side, for two reasons: First, the existing nozzle-pump is unequal to supplying sufficient pressure to break down the ground fast enough, and

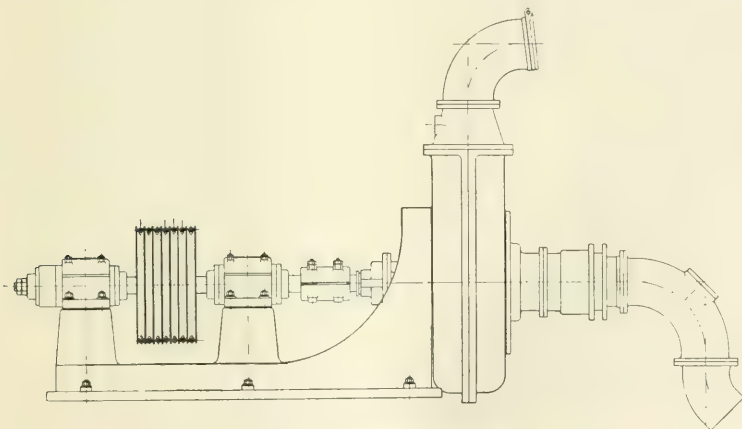
secondly, as the false bottom is very uneven, it is difficult to clean out the pot-holes. The operating cost at present is from 7d. to 8d. per cubic yard.

In addition to the plant described above, there is, on another portion of the property, an 8-in. gravel-pump driven by a 25 N.H.P. Marshall portable engine. The engine is set up on the surface and the pump placed about five feet below. No nozzle-pump has yet been installed at this spot, the ground, which is 12 ft. deep, being broken down with the help of a stream of water coming over the face. The quantity of gravel treated with the aid of 4 men breaking down the ground with picks is from 10 to 15 cu. yd. per hour. This

reduction in the working cost, and make the property highly profitable, even should the price of tin decline.

CHILEAN NITRATES.

The Chilean Nitrate industry is receiving renewed attention on the part of speculators owing to the fact that the consumption is now greater than the production. The production during the first six months of the current year is estimated at 1,218,000 tons, as compared with 1,229,000 tons during the corresponding period of 1911. The consumption in Europe during the same time is reported at 1,362,000 tons, as compared with 1,215,000 tons, and the American consumption 268,000



GRAVEL-PUMP USED AT GOSS MOOR.

quantity could be increased to 20 or 25 cu. yd. by adding a nozzle-pump, and the labour of 3 men could be saved. This style of plant has been found suitable on shallow ground (up to 12 feet deep) where facilities for obtaining a natural head are lacking. The men generally required on these plants are an engine-driver, nozzle-man, sump-hole man, sluice-man, and box-man on each shift.

The property is about 1000 acres in extent and capable of accommodating 8 plants of a size similar to the present one, and it is estimated that with such a number continuously working, the ground would take 15 years to exploit. It is anticipated that further plants will be installed, all to be driven by electricity; this, of course, will result in a considerable

tons as compared with 321,000 tons. It will be seen therefore that stocks at the mines and in Europe have been correspondingly decreased. Of the European consumption, 670,000 tons was taken by Germany, 306,000 tons by France, 236,400 by Belgium, 91,000 tons by Holland, and 86,000 by Great Britain. Though a number of new extraction works have been started, the total output is not appreciably increased, owing to the gradual exhaustion of the highest grade deposits. As regards the future, it has been estimated that the known deposits contain enough caliche to maintain the present output for 35 years. Interesting information was given on the nitrate industry by S. H. Loram in the *Mining and Scientific Press* early in 1910.

THE VALUATION OF BASE-METAL MINES

By W. H. GOODCHILD.

THE valuation of mines yielding the base metals presents a series of peculiar problems, arising from the uncertainties of the metal market. Thus an additional speculative factor is introduced in the valuation of base-metal mines as compared with precious-metal mines. This factor, however, differs from the other principal speculative elements in mining in that it is not associated in any way with the special local circumstances of the mine, but is governed by the complex exigencies of domestic and international trade and variations in supply and demand. There are so many other speculative factors in mining that the mere day-to-day fluctuations of the metal market are usually of small special interest to the mine valuer. However, long periods of high and low prices must seriously affect the value of a mining investment, therefore the problem arises as to what allowance is to be made for these fluctuations in valuation practice.

Three principal factors must be considered in appraising the value of any speculative investment:

A. The amount of the capital that may be regarded as 'secured' and the character of the 'security.'

B. The estimated probable income, if any,* and its probable duration.

C. The speculative possibilities.

In accordance with these fundamental principles of speculative investment valuation, I maintain that a sound and exhaustive valuation of a base-metal mine should involve the computation of the value of the ore and such asset calculations contingent thereto, on three distinct principles:

(1) A security basis.

(2) A probability basis.

(3) At least one speculative basis.

In an exhaustive report the results should be compiled in such a manner as to render comparison easy.

The object of the triple valuation is to guide the financier or investor in judging: (1) The basic stability of the mine and the degree of security for capital, from the point of view of the marketing of the commodity mined. (2) To give a fair idea of the probable value of

the mine as a dividend making machine, assuming ordinary and reasonable good fortune in business, also from the commodity market point of view. (3) To convey some idea of the more speculative aspects of the mine from the same standpoint.

It should be noted, in passing, that the price basis of valuation will generally affect the tonnage to be included in the estimates, and wide differences in value may arise from this cause alone.

Where two or more base metals are mined together, as is commonly the case with lead and zinc, for instance, the calculations must be adjusted accordingly.

(1) The price of a metal to be used for the security basis of valuation depends essentially on the cost of production of a proportion of the world's supply of that metal. It may be taken as an axiom that the price of a commodity cannot remain for long below the cost of production of any considerable proportion of the total supply of the commodity. An analysis of the costs of production of the world's supply of a metal in conjunction with a careful consideration of the apparent possibilities of over-production at low prices, and the various other factors in the general industrial situation in regard to the production of the metal, should enable the maximum price figure which may be used for the security basis of valuation to be determined with a high degree of certitude.

(2) The probability price takes into account the industrial outlook in respect to demand. It is to be essentially a fair and reasonable expectation of the probable average selling price, as far as the industrial outlook can be judged.

(3) The speculative price, or prices, takes into account the more speculative or doubtful elements in the industrial outlook. A speculative price may be based on long or short views, according to circumstances. It is essentially a higher price than (1) or (2).

It is, of course, common practice to calculate the value of base-metal ores and products at several metal prices, and one frequently sees valuation reports in which this is done. Such reports, however, would be of much greater utility if the prices chosen had each a certain defined significance. It will be at once asked, how are these prices to be determined

* Some speculative investments such as art treasures, for instance, yield no income; nor is a mine expected to yield income during the development period.

in practice so that they may reasonably be considered to possess the significance nominally attached to them? Therein lies the crux of the proposition.

In so far as the selling values of the commodities mined are concerned, our profession, from a business standpoint, is unquestionably lacking in adequate organization. I consider that the importance of these matters to the mining engineering profession and to the mining industry as a whole is such that the time is ripe for the establishment of a cosmopolitan mineral statistical bureau. One of the functions of such a bureau would be to collect and sift all the available data bearing on the general industrial situation and outlook of the various metals and commodities mined, both from the points of view of production and consumption, and co-ordinate them in a manner suited to meet the special requirements of mining engineering and finance; also to issue bulletins containing the kind of information required in a suitably condensed form.

The organization of such a bureau should not be a difficult matter. It could be started through the co-operation of the Institution of Mining and Metallurgy, the American Institute of Mining Engineers, and other similar bodies, together with the financial and other assistance, as far as possible, of corporations, mine-owners, and others interested in metal mining.

The organizations of the existing technical institutes, with their members scattered all over the globe, are unequalled as potential sources of supply of some of the data required. There is a vast amount of statistical information in regard to the metal industries and metal production and consumption published in various quarters, but all this information requires special co-ordination before it can be made of any service to the mine-valuer or manager. Governments collect and publish all sorts of useful statistics for their purposes. The statistical side of the metal-broking business is organized for its particular purposes. Yet, when a base-metal mine is to be financed, valued, or administered, the mining engineer has to fall back upon his own individual resources and activities as regards all matters in connection with the market-value of the commodity that it is proposed to mine. On the other hand, the circumstances affecting the market-value of these commodities are so extremely complex that it is only by properly organized inquiry and investigation that it is possible to obtain a satisfactory or useful view of the industrial situation for the purposes of mining finance and mine valuation.

One not infrequently sees adorning the walls of engineers' offices, charts prepared by firms of metal brokers, showing the course of the market for various metals for many years past. It seems to be the common practice to use some sort of average price deduced from these price charts alone as the basis of base-metal mine valuation. A more farcical performance could scarcely be imagined nowadays, especially when the vast changes in the industrial positions of the various base metals, which are taking place, are carefully considered.

As matters stand at present, therefore, the position of base-metal mining leaves much to be desired both from the point of view of security to capital and the speculative aspect of this class of investment. When such measures as these form the common practice of engineers in regard to base-metal mine valuation, is it surprising that so many capitalists and investors, who will tackle the risks of gold mining, fight shy of base-metal mining?

It is only necessary to glance at the enormous increase in the world's demand for base metals of late years to realize the great and increasing magnitude and importance of the base-metal mining industry; also the radical changes which are taking place in the world's position in regard to the supply and demand for base metals. The following table, giving the approximate annual world's consumption of the four leading heavy metals, other than iron, at intervals of ten years, in thousands of long tons, shows the enormous rate of increase in demand for base metals accompanying the recent advances of civilization.

	1880	1890	1900	1910
Lead.....	385	580	871	1110
Copper.....	154	269	512	890
Spelter.....	230	345	474	820
Tin.....	38	55	81	116

It will be seen that not only has there been an enormous increase of consumption in a relatively small interval of time but the ratios between the different metals have altered, implying far-reaching economic changes.

As a further illustration of my contention that the mere study of past metal prices affords but a poor guide for the general conduct of the base-metal mining industry, I may cite the case of the metal tin, which has been the subject of much careful investigation on my own part. It appears that £140 per ton may be taken as a 'security' price as against about half this figure in the latter half of the nineteenth century. £180 per ton is being made the basis of many flotations of tin mining com-

panies nowadays and represents some well informed opinion as to the 'probability' price, while £200 up to perhaps £250 per ton appear to be justifiable 'speculative' prices. The average selling price for tin during the last half of the nineteenth century, however, was about £100 per ton.

Investigations of this nature take up a great deal of time in the present state of unorganized and deficient statistical and other information. The results obtained are liable to error; moreover, they can scarcely have that prestige with financiers and others such as the results obtained by a well managed and organized cosmopolitan bureau should possess.

The figures given above clearly show that consideration of price charts alone, or the process of averaging past selling prices, may afford a treacherous guide to present-day security or future values.

The signs of the times undoubtedly favour the belief that there must be much increased activity in connection with base-metal mining in the not distant future. The rise in prices of certain metals, now proceeding, will doubtless, as time goes on, lead to further exhibitions of wild-cat flotation and speculative hysteria based on over-valuation of all sorts of properties. Retribution will follow as an aftermath to the detriment of the base-metal mining industry and the further discomfiture of our long-suffering and much-maligned profession. A properly organized statistical bureau might do much to prevent such occurrences and could give to base-metal mining an investment status such as it does not at present possess. The flow of capital to this branch of industry would be thereby facilitated to the benefit not only of the industry but of the mining engineering profession as a whole.

It is my opinion that, despite trade and trusts, secret syndicates and other combines, for the artificial manipulation of prices and supplies, the work of such a bureau could be made useful and effective for the many purposes connected with the engineering of base-metal mines.

Dust-Explosions form the subject of a Government report, showing that other carbonaceous matter than coal-dust when suspended in the air will give rise to damaging explosions. At an oil-cake grinding-mill at Liverpool, a belt broke and raised a cloud of dust from the substance treated. Contact with a flame caused an explosion that killed 39 people and injured over a hundred others, besides wrecking the buildings.

9Dredging in New South Wales.

The annual report of the Department of Mines for 1911 gives the following figures relating to the production of gold and stream-tin by means of dredging:

Year	Gold	
	Quantity	Value
	Fine oz.	£
1900	7,924	33,660
1901	21,100	89,628
1902	23,046	97,891
1903	24,555	104,303
1904	29,111	123,656
1905	32,038	136,090
1906	33,218	141,101
1907	36,136	153,498
1908	37,917	161,059
1909	32,635	138,626
1910	28,660	121,741
1911	23,364	99,245

Year	Stream-tin		Total value
	Quantity	Value	
	Tons	£	£
1900	—	—	33,660
1901	49	3,542	93,170
1902	110	8,300	106,191
1903	244	20,100	124,403
1904	319	26,180	149,836
1905	532	50,904	186,994
1906	1,032	120,661	261,762
1907	1,692	176,212	329,710
1908	1,362	129,952	291,011
1909	1,677	146,842	285,468
1910	1,607	158,467	280,208
1911	1,742	208,095	307,340

The Araluen division, which is still the chief centre of gold-dredging operations, has supplied the largest yield, and the ten plants at work during 1911 recovered 8960 oz., valued at £34,715, or £6096 less than in the previous year. The outstanding feature in connection with the dredging for tin ore is the enhanced yield secured by the plants in the Tingha division, the output being 792 tons, valued at £95,825, as against 660 tons, valued at £66,519, in 1910.

The dredges in operation numbered 71, of which 25 were of the bucket type and 46 were suction plants. There were 21 bucket dredges and 14 pumping plants employed in the recovery of gold, and 4 bucket dredges and 32 pumping plants in the winning of stream-tin.

The returns from 4 bucket-dredges and 28 pump-dredges used in tin-dredging are given as follow:

BUCKET DREDGES.		4
Number of dredges.....		4
" cubic yards of material treated		577,977
Total quantity of tin ore won		147 tons
Value of tin ore won		£167,365
Average yield per cubic yard of material treated		0.37 lb.
Average value obtained per cubic yard of material treated		7.29d

PUMP DREDGES		28
Number of dredges.....		28
" cubic yards of material treated		2,533,782
Total quantity of tin ore won		1418 tons
Value of tin ore won		£167,284
Average yield per cubic yard of material treated		1.25 lb.
Average value obtained per cubic yard of material treated		15.84d.

MINING LAW IN NIGERIA

By C. S. HERZIG.

THE mining law of Nigeria is embraced in what is known as 'The Minerals Proclamation, 1910,' being "A proclamation regulating the right to search for minerals and also to dig for, mine, and work minerals and for other purposes relating thereto." Under the head of minerals are enumerated ores of practically all the useful metallic and non-metallic minerals as well as precious stones and the ordinary rocks used for building and other useful purposes.

The law, as it stands and as administered, is perhaps the weakest and poorest of its kind known in any civilized country. It is administered by an advisory committee of three persons acting for the Governor and consisting at present of the Government Inspector of Mines, the Resident, and an Assistant Resident. Here we have the first weak spot, namely, the control in the hands of non-technical men. The recommendations of this committee must be approved by the Governor himself before they become effective. The Governor, of course, is usually guided by the committee.

The general provisions of the law are loosely drawn, the terms employed are indefinite, so that its interpretation necessarily rests on the discretion of the advisory committee. Further, the law is framed in such a way that there is practically no responsibility placed on the mine-owner as regards the expenditure necessary to retain rights on ground held under prospecting licence. Prior to the issuance of this law in 1910, several abortive attempts were made to frame satisfactory regulations. During that year the regulations were changed at short intervals, causing much confusion and dissatisfaction. The mineral resources of Northern Nigeria were practically untouched until the flotation of a number of tin mining companies in 1910. The Government, no doubt, is anxious for the development of the country's mineral wealth, as well as its other natural resources, but in framing the mining regulations the intent seems to have been to debar the ordinary prospector. This is a mistake. With but few exceptions the mining districts of the world have been discovered and tested, not by the trained engineer representing large capital, but by the poor prospector wandering from place to place in patient search. He requires no expensive kit, neither

knows nor cares anything for the share-market, and is content to work alone with a skill and aptitude for tracing minerals to their source that few if any engineers possess. Contrary to usual experience, the greater number of alluvial deposits so far disclosed in Northern Nigeria have been found by men of the engineer class, who have been aided by the open character of the country and have profited from the fact that the prospector class has been represented by the native worker. It is stated that all the deposits so far opened up have been discovered by black men. If the country is to be developed further, it is advisable to so alter the law as to encourage the more skillful but poorer prospector, the man whose profession is the finding of mineral in place.

In order to be in good standing, the first step necessary under the law is to secure a Prospecting Right, which costs £5, the applicant being required to show that he has at least £100 in the country. This in itself might not appear irksome were it not for the fact that such a prospecting licence confers on the holder nothing more than a right to prospect for minerals. It amounts to a registration tax. Should the prospector discover any mineral and wish to secure for himself the benefit of his discovery, he immediately faces a big obstacle. Before any actual prospecting can be undertaken an additional payment must be made for one of two kinds of tenure to the ground where the discovery is made.

The ground can be secured by means of an Exclusive Prospecting Licence or by Mining Lease. The Licence entitles the holder to the "sole right of prospecting for minerals within an area not less than one square mile and not more than 16 square miles in extent" for one year, with the right of renewal, under restrictions, for two years more. The very terms of this nullify the provisions of a Prospecting Right.

The qualifications required for securing an Exclusive Prospecting Licence are that the applicant personally or his employers shall have a capital of at least £500 per square mile applied for, the rental being at the rate of £5 per square mile per annum.

It is apparent that the requirement of £500 per square mile precludes the poor prospector

from operating. The greatest drawback, in my opinion, lies in the looseness of the provision enabling the holders of a Licence to secure a renewal for an additional two years beyond the original term of one year. Most mining countries do their utmost to prevent so-called 'shepherding' of land, that is, the retention of large areas by individuals or companies unable or unwilling to operate, as tending to hinder development. In Northern Nigeria the opposite seems to be the case. There are no labour conditions to fulfil nor is a stated amount of expenditure per square mile demanded during the life of the Prospecting Licence. The result is that several large companies with ample capital have pegged enormous areas of ground on which absolutely no work of any kind is being done.

One company holds upwards of 100 square miles under Exclusive Prospecting Licence, and most of their staff of half a dozen white men are engaged in looking for more new territory. A large portion of the ground held by them has not been touched with a pick but renewal of the Licence over ground that has lain fallow has already been granted. Another company has 64 square miles in the neighbourhood of Jemaan Daroro and the work performed is confined to a few acres. The staff is insufficient to explore this enormous territory, even if the company were so inclined. Several other companies hold areas of similar size.

In granting these large areas it is a question whether the regulations are not being contravened. In stating that a Licence may be granted for an area from 1 to 16 miles, it seems likely that it was intended that 16 miles should be the maximum granted to any one individual, otherwise why should a maximum have been stipulated at all? In practice the only effect is that single blocks are limited to 16 square miles, and as many can be applied for as desired.

As long as such a condition exists, the development of the country must be retarded. The Government Inspector of Mines suggests as a remedy that Exclusive Prospecting Licences be made non-transferable. This would help, but of itself it would be insufficient. In my view there is also required a withdrawal of the £500 per square mile requirement and the restriction of the Licence to a period of 3 to 6 months with no rights of renewal, further that those rights shall be non-transferable and that no individual shall be entitled to more than a total of 16 miles. The effect of such a regulation would require the active pros-

pecting of the ground applied for; and at the end of the period the prospector would have to protect his discoveries by applying for a Mining Lease, as in other countries. Perhaps it would be better to abolish the whole provision whereby an Exclusive Prospecting Licence is granted. Other countries have reached a high state of mineral development without granting such privileges, and why not Northern Nigeria?

Obviously the intent of the Exclusive Prospecting Licence is to secure for the holder undisturbed the right to trace the extent of his mineral discovery. As soon as this is done the law should compel the release of the ground for the benefit of the community at large. It is only fair to state that the present Inspector of Mines is endeavouring to secure remedial legislation to require a specific expenditure per annum on each tract, without which the Licence will not be renewed. This will cure two defects at one time: the obligation to work the ground, and the necessity for immediate official inspection. Distances being great in point of time and the staff small, it is sometimes impossible to make an inspection of ground to see if any work has been done. By throwing the burden of the proof on the owner, the Mines Department can act on the basis of properly certified accounts.

Even this does not seem to warrant the sequestration of large areas for long periods. The law states that "the holder of an Exclusive Prospecting Licence to prospect shall, under penalty of revocation of such licence, during the whole of the period for which such licence is granted, either by himself or his agents carry on bona fide prospecting operations." It is safe to state that not one licensee in ten has complied with the requirement of the law as here set forth, namely, that work has been carried on during the "whole of the period." At present practically all the companies hold large areas under such Licences, taking out a small area under Mining Lease, without which tin cannot be shipped. When a Lease is granted within an area held under Licence the latter should be cancelled automatically. In other words, as soon as the discovery has progressed far enough to warrant the shipment of tin, no further protection is required and the ground should be thrown open to others.

It is stated that some of the companies have secured leases over a small area and now ship tin from ground not included in such leases. Moreover, the large areas are used as bait for the public in prospectuses, and the Govern-

ment's duty is to protect the investing public from fraud. Mere acreage does not imply the presence of mineral that can be profitably exploited.

No doubt the intent of the Prospecting Licence was to protect the applicant during a period long enough to permit him to test his discovery, but so long as no compulsory work is demanded, so long as large areas of 50 or more miles in one locality are granted to one company, the law fails in effect and large tracts lying fallow remain in control of a favoured few, to the detriment of the country's de-

velopment and to the exclusion of legitimate workers.

- (3) Stream mining lease, confined to the beds of streams and not to exceed one mile in length. The rental is 20 shillings per annum for each 100 yards or part thereof.

Besides these there are leases for (4) Iron mining, (5) Carbonaceous minerals, (6) Earthy minerals and precious stones, (7) Dredging, and (8) Water-power.

The first three are the only ones of interest in the present discussion, the requirement



PROSPECTING NEAR KERRI, NIGERIA

velopment and to the exclusion of legitimate workers.

The Prospecting Licence gives to the holder the exclusive right to prospect for minerals within the area applied for. Before shipment or actual production can commence a mining lease must be granted. Of such there are eight kinds, granted for 21 years with right of renewal:

- (1) Lode mining leases, each claim being 80,000 square feet, the maximum number of claims in one lease being restricted to 30. The rental is £4 per claim per annum.
- (2) Alluvial mining leases, which shall not exceed 800 acres in area and of a minimum

being a capital of £10 per acre. Apparently no distinction is made between lode and alluvial leases as to capital requirements, although the capital necessary for lode mining is generally far in excess of that necessary to bring an alluvial property into successful operation.

Mining leases are bounded by vertical planes and no surface rights are conferred. Special application for use of the surface must be made. These are handled separately. The Department, I believe, is exercising considerable discrimination in the execution of this provision of the law.

According to Clause 14, before granting a lease the Governor may require reports by competent mining engineers. This may have

been intended originally to be a safeguard against fraud but nowhere is there any stipulation regarding the character of the work or other preliminary to an engineer's opinion. In this as in a number of other places the law shows the handiwork of an amateur. It is to be presumed that the "competent engineer's" report is to be paid for by the applicant. The scope of the engineer's report is not specified.

One good provision in the law is a severe penalty against 'salting' and furnishing false information. The filing of mine plans and accounts is required. Under the requirements mining companies are also compelled to report their monthly outputs. Presumably this is for the protection of the public and these records should be open to public inspection. I applied to the Inspector of Mines for the March outputs of the companies and I was told that these were private. Upon further investigation, it was learned that with a number of companies the output reported to the Government does not correspond with that published in the London financial papers. The Department perhaps does not realize that it is lending itself to possible fraud. Its function surely should be to prevent misrepresentation, and if the data are not collected for that purpose why is the tax-payer burdened with the expense of maintaining the Department? Statistics are not gathered for the private information of Government officials.

As has been indicated, the law is framed in a manner to throw an enormous amount of work on the Department and leaves too much to the discretion of the officials. This is a defect the remedying of which would be welcomed more warmly by the officials than anyone else, if for no other reason than relieving them of the burden of considerable unnecessary labour. Another reason is that no matter how upright or painstaking an official is, he is bound to lean to his friends and further he may change his view-point from time to time. For instance, the law states: "the Governor may refuse to renew any exclusive licence if satisfied that *bona fide* prospecting operations have not been carried on." It should be stated in unequivocal language that the licence will not be renewed unless proof satisfactory to the Department is supplied, that a prescribed expenditure has been made or prescribed quantity of mining work completed, the burden of proof to be on the mine-owner and not on the overworked officials.

Before a mining lease is granted under the present law it must be examined by an inspector of mines, apparently with the idea of

seeing that no mistake has been made in the surveys. At present, the surveys are made by men who pass a perfunctory examination, the surveyors generally being company employees with no obligation to the Government.

The surveys should be done by licensed surveyors who are bound by oath to the Government and whose survey should be proof sufficient for the Mining Department regarding that branch of the work. The statement as to expenditure could be accompanied by an affidavit. In this way the Mines Department could devote itself to its proper business, namely, the collection and correlation of statistics, and the protection of life and limb underground.

As a case in point, some time ago an application for a licence was made for 8 square miles and a plan handed in showing this area. The Inspector of Mines who went over the ground discovered that two villages, marked on the map as being three miles apart were more than a two hours ride on horseback. A re-survey was made by a Government surveyor who found some 16 or 18 miles in the area. Needless to say, the application was refused. The point I wish to bring out is that in this case the discrepancy was so great that a man riding on horseback was able to discover it, but what chance would there have been had the difference been 15 or 20%. No burden was thrown on the applicant, the survey was not made by a man obligated to the Government, and the only way the department can be assured of the veracity of the plans is in the manner already indicated: by having the work performed by a Government surveyor in the first instance.

It is well known that until recently practically all the tin produced has been won by the natives by the simple method of 'calabashing' or panning, as it is known in most other parts of the world. The tin so won is bought by the companies from the natives at so much per pound of concentrate. Practically no super-vision is exercised, the main thing being to get the tin. According to law no tin can be produced except from a mining lease, but it is a fact that a great deal comes from ground not held under mining lease.

For more than a month before they had made application for an Exclusive Prospecting Licence or had rights of any kind, a certain company was buying tin from tributers who were getting it from what is now their principal property. I do not mean to criticize this particular company or the Department, but the mining law should be amended so as

to prevent such happenings. The burden of the proof should here again be on the producer. A sworn statement or other guarantee should be required that the mineral has come from ground actually held under mining lease



A Village on the Niger.

and a heavy penalty should be imposed both on the manager and the company for any false statement. This penalty should not only include the usual fine or imprisonment, for after all the company is taking what it does not own, but include the payment of double or treble the value of the mineral so taken.

The provisions of the law covering mining leases are somewhat loosely drawn, but in one respect they are to be commended as containing a specific declaration as to the expenditure required to hold the ground. The law compels no beacons to be set up prior to 12 months from issuance and demands no mining operations for a similar period; then a mine shall not be considered "effectually worked unless it can be shown that an expenditure per annum has been incurred in respect of working the ground of at least £2 per acre in the case of an alluvial and £100 per claim in the case of a lode mining lease."

This provision is satisfactory, and were there no Exclusive Prospecting Licences it would tend to prevent 'shepherding'; but so long as large areas are allowed to lie fallow by virtue of the protection afforded by the licences the mining community will take mining leases over the smallest possible area.

Each producer of tin should be compelled to furnish a certified statement naming the source of the tin and a severe penalty should be imposed for false statements.

In addition to the recommendations al-

ready stated, it seems to me to be of the utmost importance that the administration of the law be taken out of the hands of an advisory committee and vested in a central authority such as a Secretary for Mines or Chief Inspector. The country should be divided into districts, each under the immediate charge of an Inspector of Mines, responsible to the Departmental head.

Since the above was written, there has appeared in the daily papers a communication from Mr. Astley Cooper in which he states that he has been informed by the chief secretary's office of Northern Nigeria that certain changes are contemplated in the existing mining regulations. These changes include the transfer of the Advisory Committee to Zungeru, the capital of Northern Nigeria, so as to remove them from the influences of the mining field. It is also proposed that "in future the government inspector of mines will not sit on the Advisory Committee, but would be available as an expert in the interests of the government." In my opinion the alterations, which the



Transport in the Bush.

government propose to carry out, as outlined by Mr. Cooper, will only make a bad law worse. There can be no possible reason why the Government should require an expert, for mine valuation is not within the province of any government, nor does the Government intend to operate mines on its own account. The Advisory Committee should preferably be abolished, but if it has any excuse for existence, it should remain in close contact with the mining districts, so that it may be thoroughly familiar with the conditions on which it is to pass judgment.

MINING PRACTICES COMPARED

By V. F. STANLEY LOW.

DURING the course of travelling in various countries I have often heard discussions as to the relative superiority of the methods in vogue for mining and milling the baser metals in England, the United States of America, and Australia, but it seemed to me that the bases taken for comparison were often unequal and the information available too meagre to do justice to any of the countries mentioned.

It may be held by some that, in order properly to compare the mining and milling methods of different countries, an intimate knowledge of the work and conditions of every large and small district in those countries is required. On the other hand, it may be considered sufficient to deal with certain of the most prominent centres only. Even with the latter condition allowable the task is a difficult one.

In all mining operations, profit, either immediate or future, is, or should be, the chief aim of the engineer, it being taken for granted that to work economically due regard must be given to the safety and health of the employees as well as to the safety of the property. It is of no avail for the metallurgist to show a high recovery of the valuable metals if the whole of that recovery is not obtained at a profit, any more than it is of use for the underground engineer to lower his cost by rushing out his ore without taking proper precautions for timbering and filling in order to ensure the safety of his workings. What is the utility of raising a recovery from, say, 80 to 85%, if the additional 5% costs more to obtain than the value of the extra metal saved?

Profit being the aim of the engineer, the best method of obtaining it with the means available becomes the chief question. In obtaining profit the engineer has to consider (a) the cost of production; (b) the value of the products. The cost of production includes mining, milling, office expenses, freight, amortization, etc. Value of the products is necessarily influenced by the proportion of metals recovered and the market price of those metals. Cost of production must necessarily be affected by the price paid for manual and for mechanical labour, the nature of the ground to be mined, the amenability of the ore to milling practices, the cost of material, and the magnitude of the orebodies. Where the cost

of mechanical power is low and that of manual labour is high, economy demands the extensive use of mechanical appliances; where manual labour is low in cost and power is high, then man-power may be in the ascendant, but even so, there is a great tendency to eliminate the human element as far as possible.

Granted that the costs of manual labour and the means of obtaining or producing mechanical power are the same at several mining centres, there are still many difficulties in the way of making a fair comparison. To demonstrate this fact it is not necessary to go outside of one particular district. Take Broken Hill, for example. There the North, the South, and the South Blocks mines have orebodies that may be easily mined and even more easily milled, while the Proprietary, the Central, Block 10, and the Junction North have much more difficult problems in concentration and greater difficulties, for the most part, in mining. The figures published with regard to milling recoveries and costs of operations convey to the stranger but little indication of the engineering ability displayed by those responsible for them.

With these difficulties observable in a single mining district, where the various mines are situated upon an almost continuous orebody some two miles long, it must surely be recognized how great must be the differences, and therefore the difficulty, in making a fair comparison between the excellence of the work being done in mining camps situated in several distant countries.

As it is not within the scope of this article to go into a minute dissection of varying practice, it only remains for me to give, with diffidence, the impressions left on my mind by the mining and milling methods noted at various mining centres.

In Cornwall there was far too much manual labour, the mechanical appliances in use belonged to a past generation, and the work-effort of the men was exceedingly poor. In fact, in all departments the work being performed in this part of the old world was much inferior to that being done in the younger mining districts. The reason put forth for some of the conditions was that the mines were too poor to warrant much capital expenditure in machinery and that manual labour was

cheap. The rate of wages was certainly low, but I consider that the labour, on account of its poorness, was far from being cheap. On the other hand, water is obtained for practically nothing, and coal costs only about 17 shillings per ton. Surface hands receive about 20s. per week, but the statement was made that 500 of them were required on the surface of one of the mines that treated, by hydraulic concentration, less than 2000 tons of ore per week. This figure seems inordinately extravagant. Then again, concentrating appliances, long thrown out in other parts of the world for treating copper and lead ores, are still in use in Cornwall for treating ores of tin. I was informed that modern appliances had been tried and failed to give recoveries equal to those of ancient type. I should much like to have seen some of the tests. In any case, the recoveries being made with the ancient appliances on one of the most profitable plants amounted to only about 40% of the original contents of the material treated. Miners on contract earn from 4s. to 6s. per day, so that no labour-saving arrangements are deemed necessary underground. A trip taken down one of the main shafts was a weird experience, which I trust I shall not have again to undergo. I was told that the old beam-engines, even now so much in use, were economical; but I could find no figures of any reliable tests that would serve as a basis of comparison with modern steam-engines. I am afraid the economy of the Cornish beam-engine is not appreciated outside of Cornwall, for, with the exception of a few paddle-steamers in American waters, one does not see them elsewhere in general use. It would also be interesting to know why, when hauling trucks of overburden up an inclined plane from a china-clay pit some 150 feet deep, only a single line of tramline was being used and there was therefore no empty downgoing truck to assist the engine by way of a counter-balance. However, there may be perfectly good reasons for all that appears strange in Cornwall, but I unfortunately left that district with an impression of obsolete machinery, badly paid inefficient labour, want of organization, and bad management. In America I was struck with the great use to which mechanical labour-saving appliances were put; it indeed seemed that that branch of engineering was somewhat overdone. The work on the Mesabi iron range can hardly be compared with that of the other districts, as most of the work is done by means of steam-shovels in open-cuts that are operated during the warmer months of the year. Only a small

amount of ore is gained by underground mining and but little is submitted to hydraulic concentration. Where the overburden is too deep for the ore to be economically won by open-cut methods or is too thin for the steam-shovel, stoping on the caving system is adopted. The ground is generally soft enough to be bored by means of an augur. As far as I could judge, the work-effort and skill of the men underground were no better than those observed in Cornwall. On the surface great skill is shown in the use of the steam-shovel. A shovel-gang consists of 7 men, and the shovel loads from 5000 to 7000 short tons in 10 hours. The mechanical appliances used and the large amount of material moved account for the low costs in winning and transporting the ore. The carriage between the mines and the lakes is done in 50-ton trucks over a standard-gauge railway. Each ore train is drawn by an eight-coupled locomotive, carries about 2500 tons of material, and travels from 20 to 25 miles an hour. On reaching the lake-side the trains run onto jetties standing 70 ft. above water-level. The 50-ton hopper-trucks then discharge themselves into pockets or small bins in the trestle-way and thence into specially constructed steamers. The time for loading a steamer with 8300 short tons of ore is 6 hours, but over 10,000 tons has been loaded into one boat in $1\frac{1}{2}$ hours. So excellent are the arrangements for transport by land and sea, that the total cost of carriage and handling over 100 miles of railway, 1000 miles of lake, and unloading into dumps, amounts to only 7s. 6d. per ton of 2000 lb. The unloading is done by means of grabs; over 7000 tons has been unloaded from one steamer in $4\frac{1}{2}$ hours. Surface and underground work is carried on for two shifts of 10 hours each daily. Labourers receive 8s. 9d. per shift and men on contract earn from 10s. 8d. to 16s. Underground contracts are let at about 1s. 2d. to 1s. 3d. per ton, and the total cost for all underground work amounts to about 2s. 9d. per ton.

In the underground workings at Butte and Broken Hill the same system of timbering and filling is generally used. In Butte the amount of work done underground per man appeared to be greater than in the Mesabi ranges or in Cornwall, and the general system of underground management appeared to be superior to that of the two places mentioned. One of the most complete metallurgical works visited in America was the Washoe, at Anaconda, where the management and organization appeared to be excellent. The works con-

tain hydraulic concentration plant, blast and reverberatory furnaces, roasters, briquetting, brick-making, and arsenic plants, etc. Electrical power, brought from two different sources several miles distant was being used nearly everywhere except on the local tramways, which were being operated by compressed-air locomotives. The current was entering at 60,000 and 22,000 volts before being stepped down, and about 5000 E.H.P. was being consumed. There is also a complete steam installation, which can be used in case of emergency, should the electric supply fail. The smelting arrangements at Anaconda struck me as being superior to those for concentration; the latter did not appear to me to be equal to either Utah or Broken Hill. The concentration plant was capable of dealing with 8800 tons of ore in 24 hours, and the smelters with 10,000 to 12,000 tons. I was surprised to see, on this well organized property having almost unlimited supplies of cheap electricity, locomotives driven by compressed air. The reason given for their use was the avoidance of complicated overhead wires. Each locomotive carried 2 men and frequent stoppages were necessary in order to allow the engine to fill its receiver with supplies from the compressed-air mains that reticulated the property. Although the men in charge of each locomotive were supplied with a brazier and fuel to keep themselves warm—for the winter temperature falls below absolute zero—no attempt had been made to re-heat the air before using. Generally speaking, the manual labour seemed good and efficient, but labour-saving appliances were used wherever possible. The company owns its own coal mines in Wyoming and coal costs from 16 to 17s. delivered at the Washoe works. Labourers receive 12s. 6d. whilst tappers and feeders receive 16s. 8d. per shift.

At Garfield, near Salt Lake City, the larger of the two mills of the Utah Copper Co. treats 10,000 tons and the smaller 3000 tons of crude ore each 24 hours. The crude material averages about 1·5% copper and the whole must be reduced to Wilfley-table size before treatment commences. I was much struck with the fine design of the mill and the excellent organization of the plant, which indeed appeared to work almost automatically, so few were the men in evidence. The larger of the two mills impressed me as being the finest I had seen in any of my travels. Wages averaged 7s. 11d. per shift for labourers, 10s. 5d. for mill-hands, and 12s. 6d. to 14s. 7d. for miners. The ore is won from the mine, several miles distant from the concentrators, almost entirely by

open-cutting the hillside. For the year 1910 the cost of mining and milling, exclusive of transport, was put down at 3s. 4d. per short ton.

In Australia the quality of the work done and the amount of wages paid vary greatly with the locality. I consider that at Kalgoorlie and Broken Hill the work-effort of the average man underground and the intelligence displayed are equal to, if not better than, those in any other part of the mining world. I do not consider the work of the Cobar district to be of such a high standard; that of Mt. Lyell is probably intermediate. Labour troubles have been so insistent on the Australian fields that mechanical appliances for saving human labour are much in evidence on the better managed mines. It is, indeed, questionable whether this department is not in danger of being overdone. At Broken Hill coal costs about 33s. per ton by the time it is unloaded, water for steam purposes costs 5s. per thousand gallons, and stores are proportionately dear. With these costs and the high rate of wages existing, it is creditable that some of the mines are producing their own electrical power at less than one penny per unit. The lowest wage paid at Broken Hill, on the surface or underground, is 9s. per shift of 8 hours, and on some of the mines the ore-breakers underground average 15s. per shift. The minimum wage allowable by law to contract miners is 13s., to contract truckers 11 shillings.

As the Kalgoorlie mines yield a gold ore, the milling cannot here be compared. Mount Lyell does not concentrate, but has probably the most complete pyritic smelting plant in the world. Cobar does but little concentration and Mount Morgan none. Taken as a whole, the lead concentration practices of Broken Hill are in the front rank, but, in my opinion, they are hardly equal to those at Garfield. Broken Hill is, however, the home of, and the world's leader in, the flotation process as applied to zinc ores.

For reasons already stated, no figures have been used in support of the expressed opinions, which are the result of observation rather than of mathematical calculation. Visits to the various districts mentioned have left the following impressions on my mind: Anaconda; magnitude and organization. Duluth; magnitude of operations and excellence of freight arrangements. Utah; excellence of concentration. Kalgoorlie and Broken Hill; excellence of work-effort. Broken Hill; pre-eminence in zinc flotation. Mt. Lyell; pyritic smelting. Cornwall; inefficiency.

PEBBLES FOR TUBE-MILLING

By A. W. ALLEN.

THE object of the present article is to draw attention to the amount of experimental work that has been done recently in England and America with road-repairing material, where the essential characteristics should be hardness and toughness. Gold and silver ores are, in the majority of cases, re-ground or slimed by means of pebbles or stones; and the highest efficiency is obtained where hardness is combined with toughness in the grinding medium. Water-worn flints, imported from Europe, generally meet the case; but there are numerous instances where the cost is prohibitive and where recourse must be had to a local stone. It may be said that the quality of the stone used for grinding is immaterial as long as it contains metal in remunerative quantities. One point, however, must not be overlooked: the fact that the quality of the stone selected should bear some ratio to the degree of grinding required. A soft stone will chip or fracture to an extent that may make 'all-sliming' an impossibility. So much stone will have to be added to keep the mill supplied with a normal load of pebbles that the classified under-size will increase on the over-size; and the result will be obvious. There are cases where an ore of the same class as that being milled can be used for re-grinding purposes; but it is doubtful as to whether this is practicable where the whole of the ore, together with the stone added, has to be reduced to slime in the mill. In the latter case the highest duty can only be obtained by the use of the best grinding medium. The advantages to be gained by the rounding-off and testing of a hard tough rock prior to its introduction into the mill, have already been dealt with¹. These conclusions are shared by E. J. Lovegrove² who draws attention to the fact that the natural value of the flint is only available after the edges have been worn away. Mr. Lovegrove has carried out a number of tests on every available class of stone, and a description of the methods employed cannot fail to be of interest to metallurgists. He says:

"The testing apparatus consisted of three rotating cast-iron cylinders driven by a gas-engine through a counter-shaft and bevel gear-

ing, enabling three samples to be tested simultaneously. The cylinders are 11-inch internal diameter, with three 1 in. by 1 in. angle-iron ribs bolted lengthwise in the inside at equal distances apart and parallel to the axis of rotation." The machines used resemble miniature tube-mills with the Komata lining. "All samples are subjected to the same conditions of test and to this end the samples are broken to a 2 in. gauge, numbering about 16 stones, and weighing about 4 pounds. The number of revolutions recorded by the counter is confined to 8000, and the speed to 20 revolutions per minute." Tests of each class of stone were made under both wet and dry conditions and the percentage of chips and dust produced, as compared with the original weight, was used to estimate a value for the particular stone. The material was broken either by hand or machine, and, in dealing with the results, the author says: "In comparing the hand versus the machine-broken stone, out of 10 tests referred to in the list, 8 are in favour of the hand-broken method." As regards the results with and without contact with water: "The differences between the results in the wet and dry tests are very varied, only about half the samples of flints giving better results in the wet tests; while the whole of the other rocks, constituting the majority, show a loss in the wet test varying from 0 to 2.82% above the dry test."

The results are given in detail and the stones are arranged in geological order. The quartzites, as distinct from the sandstones, would seem to hold the premier position, the flints coming about fourth. It is to be noted, however, that chalk or surface flints were used and not beach pebbles; and also that chipping and dusting were alone taken into account. No allowance was made for resistance to fracture. In a few instances the flint pebbles formed were given a secondary treatment with the result that no chippings were found and only a small percentage of dust. This led the author to state that: "Once the sharp edges of the flint are worn away its natural hardness causes it to take a very high place in the attrition tests." Unfortunately no secondary treatment was carried out with any other class of stone so no definite comparison can be drawn.

A further series of tests on similar material

¹ *The Mining Magazine*, September 1911

² 'Attrition Tests in the Light of Petrology,' by E. J. Lovegrove, John S. Flett, and J. Allen Howe. Published by *The Surveyor*, London.

has been made by L. W. Page, of Washington, D.C., and the results were published in *The Surveyor*, April 15, 1910. An independent value for hardness and toughness was obtained in each case and several hundred samples of stone, flint, and slag were tested. The methods employed were as follows:

"By hardness is meant the resistance of a rock to the grinding action of an abrasive agent like sand, and it is tested as follows: A core of 1 inch diameter, cut from the solid rock, is faced off and subjected to the grinding action of sand fed upon a revolving steel disc against which the test piece is held with a standard pressure. When the disc has made 1000 revolutions the loss of weight of the sample is determined. In order to report these results on a definite scale, which will be convenient, the method has been adopted of subtracting one-third of the resulting loss in weight in grammes from 20. Thus a rock losing 6 grammes has a hardness of $20 \text{ minus } 6 \div 3$, or 18. Experience has shown this to be the most convenient scale for reporting results."

"By toughness is meant the resistance a rock offers to fracture, such for instance as the striking blow given by a shod horse. This property is tested in a specially designed machine built on the pile-driver principle, by which a standard weight is dropped upon a specially prepared test piece until it breaks. The height in centimetres of the blow which causes the fracture of the test piece is used to represent the toughness of the specimen."

By the adoption of the above methods of test the porphyries and porphyrites may be given the first place as possessing maximum toughness and hardness. Unfortunately the flints available were not large enough for the tests, so no figures are given as to any characteristics apart from water absorption, cementing value, and weight. The high place taken by the quartzites in the results of Lovegrove's tests is not confirmed by the investigations of Page, who shows that brittleness detracts from average value. In dealing with the subject of brittleness, Lovegrove states that "the chips produced may be considered in a measure as an indication of brittleness." The results from the treatment of iron slag are interesting, since practically no chips were produced, and a low percentage of dust. When tested under Page's method, a low value for toughness results in every case and no resistant value, apart from hardness, is shown.

It is well known among metallurgists that there is a wide variation in the effective value of commercial flints. The "best quality" of

one dealer is often the "medium" of another; and it is no uncommon result to find that a considerable percentage of a tube-mill charge of flints will fracture during the first few revolutions of the mill. In view of the extensive trade now being carried on with European flints in all parts of the world it is surely time that some standard of quality should be set; and Mr. Page's method of ascertaining both hardness and toughness seems to be peculiarly well adapted for the purpose of setting a value on flint or other stone to be used for this special purpose.

The necessity for further investigation may commend itself to those who are in the enviable position of being able to carry it out; and a distinct line of research would be preferable to any attempted amplification of standard results in other details of tube-milling work.

The Nickel Deposits in Norway are extensive, and much of the ore runs as high as 2% metal. In former years, the local industry was of importance, but the competition of the better ores in Canada and New Caledonia practically killed it. At the present time only the Evje mine is producing, and the output for 1911 was 25,200 tons of ore. The Ringerike mine is being reopened. The ore is treated by the Christiansand Nickel Refining Works Company, which also imports some ore and matte from other countries. The capacity of the plant is 30,000 tons of ore per year, and during 1911 the output was 285 tons of nickel, together with 80 tons of copper.

Aluminium in America.—The latest 'trust' to be attacked in the United States courts is the Aluminium Company of America. It is charged with being a monopoly restraining interstate and foreign commerce in violation of the Sherman law. The company has consented to a modification of its methods of business, so that litigation is avoided. The chief accusation was that there were agreements with three other companies, potential competitors, restraining them from engaging in the manufacture of aluminium, and from selling bauxite to anybody except the Aluminium Company of America. These agreements have been re-retired, as was also an alleged agreement with the Neuhausen company whereby no aluminium was to be exported to Europe. At the present time there is no hardship in refraining from selling American aluminium in Europe, because the price on this side is too low; though perhaps it will not remain so for long, if the new European convention is a success.

PRÉCIS OF TECHNOLOGY

Skinner's Hydraulic Classifier.—In our last issue we described the latest type of Richards' pulsator classifier *Metallurgical and Chemical Engineering* for June contains an article by Lewis B. Skinner describing his investigations in hydraulic classification, and his modifications of the Richards machine, based partly on the principle of the Henderson classifier. The latter machine involves the same idea as that of Richards, in that it removes the slime first, but the travel of the pulp across the machine is effected by inclining the feed channel instead of using a pulsating

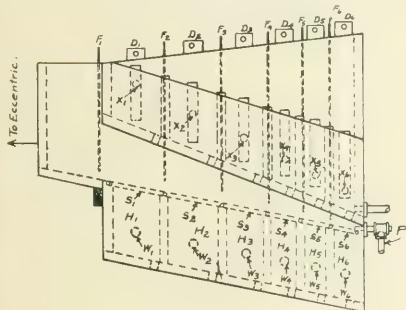


Fig. 1.

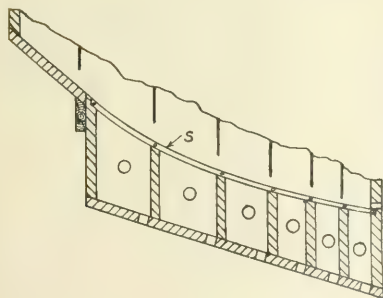


Fig. 2.

motion of the hydraulic water and a horizontal screen. The machine however had some disadvantages, the chief of which was due to the unnecessary agitation of the pulp by the force of the hydraulic water that issued through narrow slots at the bottom of each compartment. Mr. Skinner's experiments started with a standard Richards pulsator with the screen at an angle of 20° or less. He found that this helped in the classification as well as effecting the transport of the particles through the machine, for naturally the largest and heaviest rolled down fastest. Further experiments showed that if, by means of slides, the head in any compartment was about an inch greater than in the preceding compartment, a gentle flow of hydraulic water in the opposite direction to the particles was induced. In this way fine material was prevented from getting beyond its proper compartment. It was found

also that the inclined screen has a much longer life than the horizontal screen. Mr. Skinner is also in favour of making the disentangling action independent of that of the hydraulic water, so that the two actions may be controlled separately, and he therefore imparted a horizontal vibrating motion to the machine itself by means of an eccentric action instead of to the water. The annexed Fig. 1 gives a diagrammatic sketch of the Skinner machine. The classifying compartments are marked (C_1) to (C_6), the hutches (H_1) to (H_6), and the screen (S_1) to (S_6). The last-named is inclined at 15° , and it is made of brass bars, 0.025 in. thick and spaced 0.025 in. apart, being in the form of a grizzly. Hydraulic water without pulsations is introduced into each hutch at a velocity regulated suitably for each compartment. In Fig. 2 a more recent modification is shown, according to which the inclination of the screen is decreased by steps from the first to the last compartment, it being found that a greater inclination is required the greater the average difference of the two classes to be separated.

New Plant at Broken Hill.—The *Mining Journal* for June 15 contains a description of the plant erected at the Junction North mine at Broken Hill. As this is a type of modern plant for treating zinc-lead sulphides, we append an abstract herewith, omitting only the details of conveyors, de-waterers, boilers, dynamos, engines, etc., and content ourselves with the general statement that labour is reduced to a minimum. The ore is first reduced in a Gates breaker to 3 in. and then to $1\frac{1}{2}$ in. in a jaw-breaker. From this it is sent to rolls 33 in. in diameter with 18 in. face, where it is reduced to 3 m.m., a Callow screen being used to return the over-size. The product is sized into two classes, above and below $\frac{1}{2}$ m.m. The former class is treated in May jigs, in which a lead concentrate is recovered, and the remainder sent for re-grinding to tube-mills; the latter class is treated on tables, where a lead concentrate is made and the remainder is sent to Minerals Separation flotation plant. The tube-mills are of the Krupp type 10 ft. long by 5 ft. diameter, and are calculated to reduce the material to $\frac{1}{2}$ m.m.; any over-size in the discharge is reduced in Forwood Down grinding pans. The zinc-lead concentrate from the flotation plant is separated into three sizes, which are sent to Wilfleys, sand vanners, and slime vanners respectively, for the purpose of separating as far as possible the galena and the blende, and producing lead and zinc concentrates.

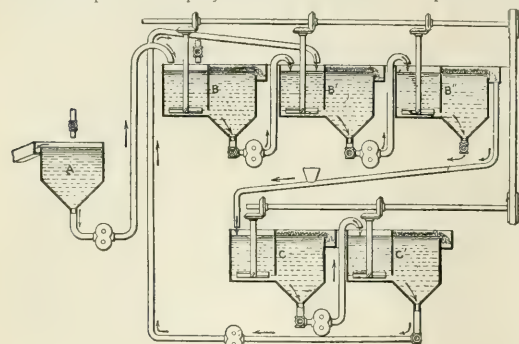
Separation of Zinc and Lead Sulphides in Slime by Flotation Processes.—In the *Australian Mining Standard* for April 11, 18, and 25, and May 2, Kenneth A. Mickle continues a series of articles on the flotation of minerals the first part of which appeared in the same paper during April 1911. Mr. Mickle is now chemist to the Great Fitzroy mine. In the present articles he gives the result of researches in connection with the relative value of various liquids as frothing agent, the adsorption of various oils and liquids by the surfaces of minerals, and the effects of the addition of acid. To the general reader, his notes on a new method of separating the lead and zinc sulphides in the slime is the most interesting part of the articles. Broken Hill slime is too fine for tables or vanners, and as an alternative it has been proposed to treat it in such a way as to make one of the sulphides unamenable to flotation. The only proposition so far before the public is that devised by E. J. Horwood, of the Broken Hill Proprietary. According to his process, the slime is given an oxidizing roast at a low temperature; the blende is not affected, but a coat of lead sulphate is formed on the galena, and if the

roasted mixture is submitted to flotation, the sulphated galena acts as gangue and falls to the bottom. Mr. Mickle has tried several chemical solutions with the same object, and gives details of the results obtained by ferric chloride. The action of ferric chloride solution is to cause the formation of a film upon the galena that is more coherent and less easily detached than that produced by the roast. The coat consists of sulphur and lead chloride, together with some iron oxide precipitated from the solution. Any lead that is dissolved is reprecipitated by the sulphuric acid used in the flotation operation. The ferric chloride is reduced to the ferrous state and can be easily regenerated. The author gives details of a number of laboratory tests of this process that show the practicability of the idea.

Hyde's Flotation Process.—A few months ago we recorded that James M. Hyde had erected a flotation plant for the treatment of zinc tailing at the Butte & Superior company's mine, at Butte, Montana, mentioning that Mr. Hyde used to be in the service of the Minerals Separation company and that the latter com-

would remain in suspension for over 24 hours. The pulp, as produced, contained from 29 to 100 or more parts of water by weight to one part of ore, to which was added, before thickening, from one-quarter to one-half pound of sulphuric acid per ton of ore. The thickened pulp was heated in the flotation machine by live steam to expand the gas bubbles, and facilitate coating the sulphide particles with the oil used, which, in this case, was candle-maker's red oil. The oil consumption cannot be calculated beforehand, but must be gauged by experience. The ore fed carried 23.3% zinc, the concentrate, 51.4%, and the tailing, 3.2%, indicating a 91% recovery. The concentrate from the primary section of the machine ran 38 to 42% of zinc. The Butte & Superior ore contains enough rhodochrosite to generate the carbon dioxide needed for its flotation.

We have quoted this article in some detail, though we are at a loss to know in what way the plant and process differs from that of the Minerals Separation company. Further comment is however inadvisable at present owing to the lawsuit mentioned above.



Hyde's Flotation Process.

pany had commenced an action for infringement of patents. The *Engineering and Mining Journal* for June 1 contains a description of Mr. Hyde's plant and process. After the ore is crushed, it is mixed with acid, and then sent to the thickening tank (A). It is stated that by adding the acid in advance, a smaller amount is required, and that it promotes the settlement of colloidal material. This settlement can also be aided by the addition of copperas, or alum. The pulp is then pumped to the first treatment tank (B), where oil is added and incorporated by agitation. A first crop of concentrate is obtained here by flotation, and the remainder of the pulp is sent to succeeding tanks (B_1 and B_2) where further concentrate is recovered. The concentrate contains silica, so it is re-treated in other tanks (C and C_1), the tailing from which is returned to (B_1).

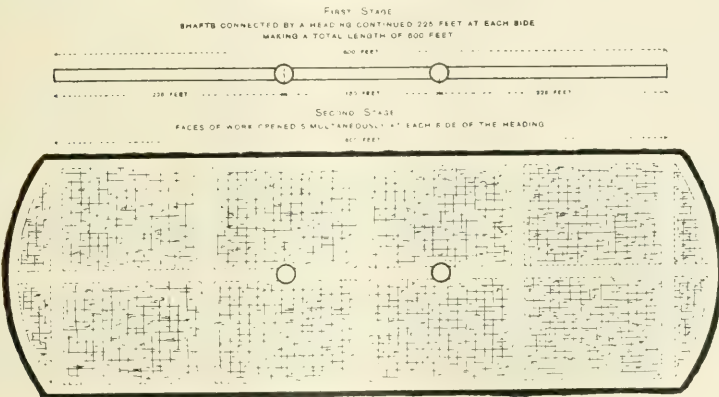
We quote from the article as follows: "As an example of actual work with this machine, the following description is given. The material treated was the slimy portion of an ore, consisting principally of quartz, blende, and various amounts of decomposed granite, in which the feldspars were largely kaolinized. About 92% of this material was fine enough to pass a 150-mesh screen. Without the use of a coagulant, part of the slime, containing a notable percentage of zinc,

Miami Copper Deposit.—In the *Mining and Engineering World* for May 18, Walter Harvey Weed reviews the geology of the Miami copper district, Arizona. The Miami, Live Oak, Inspiration, and other ore-bodies occur in shattered, much silicified schists at and near the contact with a mass of granitic rock ('Schultze' granite) that gradually changes into quartz-porphory at its borders. The profitable ore is confined almost entirely to the schist, though tongues of granite-porphory in the schist are also ore-bearing. Unlike geologically similar districts this belt does not show an extensive and intense alteration of the granitic rock into a sericitic mass with accompanying impregnation by chalcocite. The granitic area is faulted and brecciated, but has only a low copper content even in the most crushed parts; other parts contain only a

few small veins of pyritic matter, mostly oxidized. A second conspicuous characteristic of the deposit is the abundance of chrysocolla that occurs not only as a staining material through the rocks but in the form of veins of solid copper silicate which have been mined at the Keystone and Live Oak. The ore deposits owe their origin to the intrusion of the 'Schultze' granite through the schists. The primary mineralization was at the contact and on both sides, the minerals being pyrite and chalcopryite, with some molybdenite. These minerals were not profitable, and the portions now worked are those enriched by descending solutions carrying copper from the oxidized lean ores near the surface. These solutions replaced pyrite in the unoxidized zone with chalcocite. Subsequently the oxidized zone was eroded and entirely removed, and then began a period of oxidation of the top of the enriched zone, the upper layers of chalcocite being oxidized and the copper carried downward again to form chalcocite once more. This oxidation extends downward for 200 to 300 ft. Ore deposition is still going on, for bands and seams of chalcocite and quartz have been formed in the clays of the most recent faults. The author also reviews at some length the geological evidence points to the granitic intrusion having taken place in Tertiary times.

Shaft-Pillars.—At the June meeting of the Institution of Mining Engineers, held in London, W. H. and B. H. Pickering read a paper entitled 'Why Leave Shaft-Pillars.' The paper referred to coal-mining practice, and is not of immediate application to lode mining, but is of general interest to the engineer. The proposition is to leave no shaft-pillars when opening a coal mine, but to mine the coal and replace by stone packing. In this way the settlement will not be so great and will be more even, and the shafts will not be so liable to get out of plumb. Also the gob-fires due to crushing will be avoided. The method would not be possible unless the seam is fairly horizontal and unfaulted. The metal-mining engineer hardly realizes the extent of the shaft-pillars left in coal seams. The conventional rule is to leave pillars having a diameter equal to the depth of the shaft, and this is quoted as best practice by H. W. Hughes. Lupton recommends a diameter equal to two-thirds of the depth; on the other hand, Merivale is content with one-sixth to one-

Prevention of Coal-Dust Explosions.—In his presidential address at the meeting of the Institution of Mining Engineers held on June 6, W. E. Garforth gave details of his method of rendering coal-dust innocuous as an explosive agent in coal mines by sprinkling the workings with stone-dust, that of clay-shale being preferred. Mr. Garforth's experimental station at the Altofts colliery used for investigating the phenomena of explosions is well-known, equally with his rescue apparatus. He first noticed this damping action at an actual explosion at the Silkstone pit in 1886, but it was not until 1908 that he had the opportunity of testing this effect of stone-dust scientifically. These experiments have definitely proved the efficacy of stone-dust for this purpose, not only in limiting the range and travel of an explosion, but in reducing the amount of deleterious gases, particularly carbon monoxide, which it is estimated is the cause of 80% of the deaths in mine explosions. Since this fact was experimentally established, the Altofts colliery has been treated



DEVELOPMENT OF COAL MINE WITHOUT LEAVING COAL IN SHAFT-PILLARS.

tenth. But in any case it is obvious that enormous amounts of coal have to be locked up in this way. The authors, after discussing alternative proposals for working this coal, elaborate their own specific plan. In case the two shafts required by law are 150 ft. apart they connect the two by a heading, which they continue for 225 ft. from each shaft. Two longwall faces are started back to back simultaneously for the whole length of the heading, all the time keeping tight packs of stone close to the working face. The accompanying illustration gives an outline of the proposed method, though the arrangements for haulage and ventilation are not shown. The success of the method would largely depend on the amount of care exercised in the selection of the stones used in the packing and in building the packs. The stone would be usually supplied from the rock excavated when sinking the shafts. If the thickness of the seam was 6 ft. and the diameter of the shafts as sunk 24 ft., it is clear that the rock removed in sinking the shafts would be ample for packing purposes. The authors are aware that their proposals are somewhat revolutionary, and they expect to elicit many comments and records of experience.

in this way, and three years' experience has shown that the cost is extremely low and that no incidental disadvantage such as interference with the health of the men is discernible. The method adopted is to strew the stone-dust by hand wherever coal-dust accumulates, whether on the floors or on the sides of the workings. The distribution is done by boy-labour, the boys advancing along the workings with their backs to the downcast, so as to prevent the dust blowing in their faces. The stone-dust is forcibly thrown upon lodgments of coal-dust on ledges or on the sides, and the coal-dust is thus removed and thrown to the ground, to be covered by the excess of stone-dust falling subsequently. After the workings have been sprinkled with stone-dust and this becomes subsequently covered with another layer of settled coal-dust, the workings are brushed or raked so as to mix the layers. As time goes on and another layer of coal-dust forms, the sprinkling of stone-dust is resumed; and so on, with alternate rakings and sprinklings. Mechanical methods of sprinkling have been tried, but they are not so satisfactory as hand labour. The cost of this process is less than one-twentieth of a penny

per ton of coal. In some cases ledges may be fixed upon the walls for the express purpose of providing additional amounts of stone-dust. The inconvenience caused by the stone-dust is trivial as regards extra cleaning of the car-axes and the clogging of electric bell circuits. Mr. Garforth has tested a great many stones for use for this purpose from the point of view of the men's health, and finds the shales overlying the coal seams to be generally the best.

Examining Coal by X-Rays.—At the June meeting of the North of England Institute of Mining and Mechanical Engineers, F. C. Garrett and R. C. Burton read a paper describing their experiments with X-rays for the examination of coal. Coming so soon after James Lomax's paper on the examination of coal by means of the microscope, an abstract of which appeared in our March issue, this paper created unusual interest. The carbon and organic parts of coal are much more transparent to X-rays than the mineral constituents which subsequently form the ash, so that an examination by radiography indicates the presence and distribution of the mineral substances. It is possible in this way to get an idea of the value of the coal from the point of view of ash, and by observing the size of the shadow to estimate whether the mineral can be removed by washing. The authors publish many radiographs of various coals, and of these one of the most interesting is that of the Victoria-seam coal from Durham. The ash of this coal amounts to only 14%. The coal on examination exhibits a columnar structure, and the authors connect this structure with the characteristic of being a good coking coal, though several speakers at the meeting expressed a doubt as to the connection. The authors also state that the X-rays serve to differentiate certain minerals such as calcite and pyrite. Though the paper only gives the results of a tentative series of experiments, it opens up an important field of research.

American Copper Production.—The *Engineering and Mining Journal* for May 25 gives the revised statistics of production of copper in North America, together with the figures issued by the American refiners, and a table differentiating the domestic and foreign sources of ore and blister copper:

PRODUCTION OF COPPER IN THE UNITED STATES. (In Pounds)

State	1910	1911
Alaska	5,008,171	19,412,000
Arizona	299,606,971	300,578,816
California	45,793,894	36,806,762
Colorado	10,127,012	8,474,848
Idaho	6,216,461	3,745,210
Michigan	221,400,864	216,412,867
Montana	286,242,403	371,963,769
Nevada	63,877,500	65,385,728
New Mexico	3,632,351	1,518,288
Utah	125,042,381	138,336,905
East and South	18,195,450	19,656,971
Other States	1,106,525	1,564,207
Totals	1,086,249,983	1,083,856,371

PRODUCTION OF COPPER IN NORTH AMERICA (In Pounds)

Country	1910	1911
United States	1,086,249,983	1,083,856,371
Canada	1,492,252	76,370,754
Mexico	18,797,217	19,130,331
Cuba	7,799,514	8,274,563
Totals	1,284,339,246	1,284,932,019

AMERICAN REFINERS' PRODUCTION (In Pounds)

Class	1910	1911
Electrolytic	1,151,624,597	1,156,627,311
Lake	221,400,864	216,412,867
Casting	32,193,196	22,977,534
Pig	46,903,463	35,920,626

Totals

AMERICAN SMELTERS' PRODUCTION (In Pounds)

Source	1910	1911
North American ore ...	1,284,339,246	1,284,932,019
Foreign ore	41,976,733	34,392,091
Scrap	10,962,099	18,529,547

Totals

To foreign refiners.....

To American refiners...

Blister copper imported

Total crude copper

Temperatures at St. John del Rey.—A year ago we quoted in this column the investigations made by George Chalmers into the rock temperatures at the St. John del Rey gold mine in Brazil, and we reproduced the chart by means of which prognostications were made as to what might be expected at greater depths. We revert to this subject once more, as Mr. Chalmers has published additional information of importance in his yearly report. During the year, particular attention has been paid to ventilation, with results that are encouraging, and during the current year further reductions may be confidently predicted. The old Capell fan, that did duty for many years, has been replaced by new Sirocco fans, each of which is driven by a 150 hp. electric motor. One of these was started on February 20 last, and the air in the lower workings was immediately rendered less hot and stuffy. The accompanying chart shows the mean temperatures during the four hot months December to March of 1910-11 and 1911-12. It will be seen that the rock and air temperatures have been appreciably reduced, and next year, when the whole of the ventilation will be done by the new fans, there should be a further substantial reduction. The points (A) and (E) represent the rock temperatures at Horizons No. 14 and No. 17 when first opened. The line connecting them reaches Horizon No. 22, 6500 ft. from surface, at 117° F. On the other hand, the full black line to the left may, with some degree of safety, be taken to represent the ultimate air temperature of the workings obtainable by the use of suitable ventilating apparatus. At 6500 ft. the temperature would be 95° F. The rock temperatures are taken at the bottom of 10-ft. holes, and those of the air in the downcast. A further improvement is being made by Mr. Chalmers for the purpose of avoiding the chilling of the workmen as they leave the mine. At present the incoming air is drawn through the adit, and when the men leaving after the night shift walk along the adit they face the full current of incoming air at a temperature of perhaps 50° F. lower than that of their working place. In future the air is to be drawn into the mine from the surface through shaft "D" instead of through the adit.

Iridosmine in Rand Banket.—The *South African Mining Journal* for May 18 and 25 contains a paper by C. Baring Horwood on the occurrence of iridosmine in the Banket at the New Kietfontein, the isolated mine five miles north of the Main Reef series of the

JUNE, 1912.

67

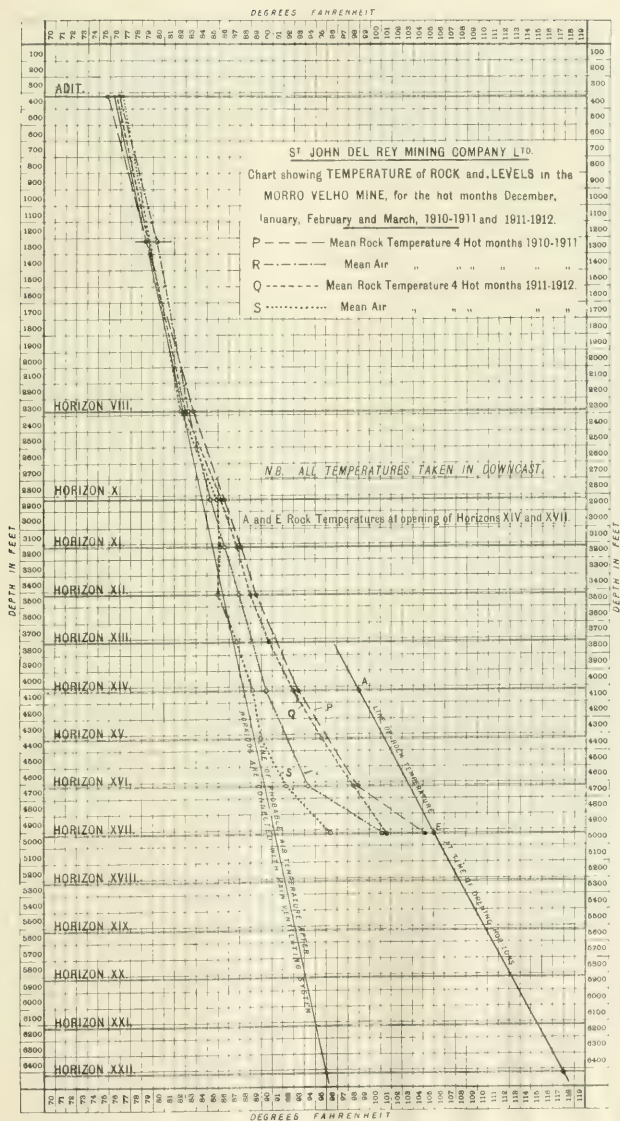


CHART SHOWING TEMPERATURES AND ESTIMATED TEMPERATURES AT THE ST. JOHN DEL REY GOLD MINE.

Witwatersrand. Iridosmine is an alloy or mixture of iridium and osmium, together with traces of other metals of the platinum group. Andrew F. Crosse was the first to notice the presence of this mineral in Rand banket, having found it in the black sand or pyritic concentrate at the Modderfontein and East Rand Proprietary, and also at a property at Klerksdorp. The first published account was contained in a paper by R. B. Young read before the Geological Society of South Africa in 1907, in which he described the Du Preez series found at the New Rietfontein. Mr. Horwood was four years ago connected with the New Rietfontein and conducted further investigations into the subject. He found that the iridosmine occurred chiefly in the Carbon leader, a narrow 'reef' of banket varying in thickness from a mere streak to 2 or 3 inches. In this leader the gold is associated with carbon, as Mr. Horwood has already described in a paper abstracted in the *Précis of Technology* for March 1911. The quantity of iridosmine present is too small to be of commercial value, for it took several months to collect two ounces by grinding and panning the black-sand concentrate. Analysis showed that nickel and iron are also present, and as already mentioned, carbon is a constituent of the ore. Mr. Horwood quotes Thomas & Macalister and Vogt to show that the original home of such a combination would be a basic or ultra-basic igneous rock, and he deduces that the many big diabase dikes on the Rand would be the ultimate source of the iridosmine found in the banket. Microscopical examination shows the iridosmine particles, and also the gold, to be crystalline in structure, so that they must have been deposited from solution. If they had been an original constituent of the banket, they would have been rounded and water-worn. Mr. Horwood's paper enters into great detail, and contains much matter of general interest with regard to the origin and constitution of the Rand deposits.

Sedimentary Rocks of Rhodesian Plateau.—The *South African Journal of Science* for May contains an article by F. P. Mennell describing the sedimentary rocks of the Rhodesian plateau. This region, the 'high veld,' consists chiefly of ancient metamorphic rocks into which are intruded great masses of granite, and the sedimentaries are of less importance. In fact they are not often seen by travellers, for as they weather rapidly, they make poor ground for main permanent roads and lines of communication. They consist almost entirely of sandstones interspersed with isolated flows of basic igneous rock, and they have been called the 'Forest Sandstones' by A. J. C. Molyneux. Their weathering has been the source of the light sandy soil, which encourages the growth of the only trees of any size to be found in this region. The layers of basalt rocks are often found as caps of table-topped hills, the overlying and adjacent sandstones having been removed by weathering. The sandstones can be divided into two classes, lower white and upper red. The former are devoid of bedding planes, and often exhibit a kind of spheroidal jointing. They are very fine grained, and under the microscope the grains are shown to be rounded as if they had been wind-worn. The cement is generally chalcedonic silica and sometimes opal. The red sandstones are rather coarser in grain, and are distinctly bedded, often even flaggy. The cement is chiefly iron oxide. Other beds are also found having a colour from pale pink to brown. The bedding of these sandstones is generally almost horizontal, and the dip is nearly always northerly, thus showing that the Zambesi river occupies a synclinal fold. It is probable that they belong to the Jurassic

period, and their total thickness, apart from the intercalated flows, is never greater than a few hundred feet. As regards the distribution of these rocks, they are found on the watersheds between the larger streams that run toward the Zambesi, and it is seldom that they extend across a water-course. From this it is clear that the metamorphic area of the plateau represents the original plain of denudation on which the sandstones were deposited. There are still extant many natural features of the country that date from the ages before the deposition of these rocks. For instance, a dolerite dike, which forms a long rocky ridge near the Shangani river near the Leopard road, disappears under the sand on the rising ground near the Vungu, and emerges quite unexpectedly as a ridge just north of that river, together with the granite in which it is intrusive. Also the ridges of banded ironstone, which form such a prominent feature of the schist areas, are probably of an earlier period, and the disposition of the water-courses through these ironstones can only be explained by their having originated prior to the denudation of the sandstones.

The Kent Coalfield.—At the meeting of the Geological Society of London held on June 13, W. Boyd Dawkins read a paper giving further evidence as to the extent of the southeastern coalfield. As the two groups operating in this district appear now to be emerging from their state of chronic wants of funds, the present paper by the geologist to whom is due the original successful proof of the existence of these coalfields is of special interest. The first experimental borings to test Godwin Austen's theory were made at Netherfield near Battle Abbey, 12 miles northwest of Hastings. The bore-hole was sunk 1905 ft. and was still in Oxford Clay, so it was abandoned, as the Paleozoic floor would be too deep for profitable coal-mining. Subsequently, at Professor Boyd Dawkins' recommendation, a bore-hole was sunk at the Channel Tunnel works at Shakespeare Cliff, two miles west of Dover. This work was done during the years 1886 to 1892, and coal measures corresponding to the Pennant or Middle Series of the Bristol and South Wales Coalfield were cut at a depth of 1100 ft. below sea-level. The same series was found in 1899 at Ropersole, 8 miles north of Dover, at a depth of 1180 ft. below sea-level, and in 1902 at Ellinge, 5 miles west of Dover, at a depth of 1286 ft. In these three borings the strata of the Coal Measures are practically horizontal, a fact which, in the opinion of the author, shows that they form the bottom of a syncline having its long axis in a northwesterly direction from Dover and parallel to the scarp of the North Downs. A boring was made at Brabourne 13 miles due west of Dover in 1897-8 under the direction of Brady and Etheridge. It established the fact that at the base of the North Downs the Paleozoic floor, cut at a depth of 1789 ft. below sea-level, consists of highly inclined strata probably of Devonian age. These are covered by dolomitic conglomerate and Triassic marl, the section being identical with that of the Mendip hills in Somerset. The deduction is that the southwestern boundary of the coalfield is to be looked for at a sufficient distance east of Brabourne to allow of the presence of the Carboniferous limestone and the millstone grit. These results were laid by the author before the Royal Commission in 1903, and subsequently further investigations were conducted under his direction. The first of these was at Waldershare during 1904-7. Here the Coal Measures were found at 1069 ft. below sea-level, in two distinct groups, the upper belonging to the Pennant series with an average dip of 10°, and the lower with a dip of 20° corresponding to the lower group of

Somerset, Gloucester, and South Wales. The next boring undertaken was at Fredville, in the years 1905-7, where the lower group was met at 1109 ft. below sea-level, dipping at 17° . Borings at Chilham, a few miles west of Canterbury, and at Bobbing, near Sittingbourne, were sunk in 1910-11. The first of these struck the Upper Silurian shales at 1072 ft. below sea-level and the second cut the Silurian grits

the Capell, Guibal, and Waddle types. The greatly reduced diameters and the increased speeds of the modern fans are obvious to the most casual observer, but the important change is in the internal construction. In the old types the blades extended from the shaft-boss to the circumference, whereas in the new types there are no blades in the centre and only short ones around the circumference. Various shapes of blade were used in the old types. In the Guibal type the blades were straight and inclined backward. In most of the others they were curved backward and were almost tangential at the circumference. In the new types the blades are short and curved, the concave surface facing the direction of rotation. In the Chandler fan the scooped blade is curved backward at the outside edge. The number of blades is greater in the new than in the old types. The latter used to have eight or ten, and the former have anything up to sixty. The reason given for the change is that in the old types the distance between the blades increase from the centre to the circumference, forming dead spaces and giving rise to eddy currents which hampered the free passage of the air, while in the new types the large number of small blades cut the air into as many small streams, the course of which is not hindered by eddies, thus greatly reducing the internal resistance.

CURRENT LITERATURE.

Stope-Filling.—In the *Mining and Engineering Review* for May, Ernest K. Hall describes caving methods for obtaining the necessary waste for filling the stopes, adopted at the Tasmania and Progress mines, in Tasmania and New Zealand respectively.

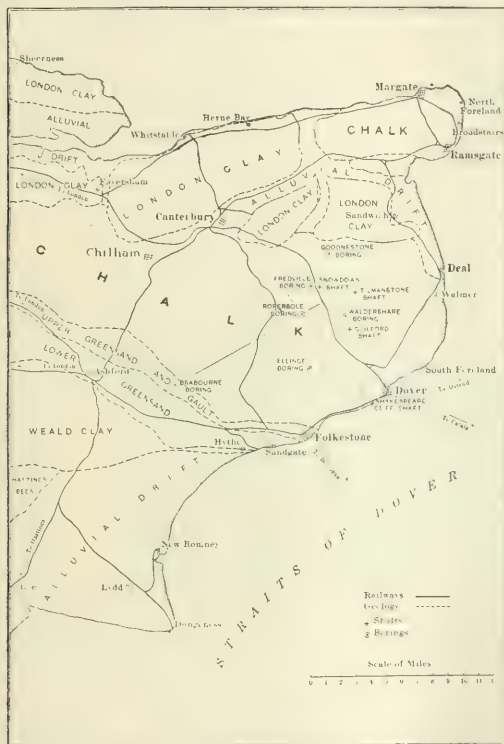
Crushing Rolls.—*Metallurgical and Chemical Engineering* for June describes the large rolls made by the Traylor company for the Miami copper mine. The free roll is automatically moved longitudinally slowly, in order to reduce grooving.

Prospecting by 'Wireless.'—*Zeitschrift fur Praktische Geologie* for April publishes an article describing a method of prospecting for orebodies by means of Hertzian waves. The *Mining and Engineering World* for June 8 gives a translation. It will be remembered that a somewhat similar apparatus was tried in Wales and Cornwall eight or nine years ago.

Cyaniding Antimonial Tailing.—In the *Mining and Engineering Review* for May, W. A. Longbottom describes the method of cyaniding the weathered antimonial tailing in the Hillgrove district of New South Wales, adopted by W. H. C. Lovely.

Refractory Manganese-Silver Ores.—The *Mining and Scientific Press* for June 1 and 8 contains an article by W. H. Coghill on the cyanidation of manganeseiferous silver ores.

Origin of Zinc Smelting.—In the *Engineering and Mining Journal* for June 15, W. Hommel gives the



The Kent Coalfield.

and shales at 1070 ft. below sea-level. In both borings the Silurian rocks are nearly vertical. It is clear therefore that the northern limit of the coalfield is somewhere between Fredville and Chilham.

Modern Ventilating Fans.—A paper was read by W. Charlton before the South Staffordshire and Warwickshire Institute of Mining Engineers on June 17 reviewing the changes that have taken place in the design of ventilating fans, used in mines, during the last 10 or 15 years; it forms a useful supplement to Walton Brown's paper read in 1899 before the Institution of Mining Engineers and Halbaum's paper read in 1900 before the same society. Mr. Charlton takes the Sirocco, Barclay, and Chandler fans as examples of the modern type, and compares them with the older machines of

early history of zinc metallurgy, tracing its origin to India and China.

Electric Furnace for Precipitate and Concentrate.

—In the *Engineering and Mining Journal* for June 15, H. R. Conklin describes the electric furnaces used at the Lluvia de Oro mine, Chihuahua, Mexico, for melting cyanide precipitate and smelting gold-silver concentrate.

Wardner, Idaho.—In the *Mining and Scientific Press* for June 1, Oscar H. Hershey commences a series of articles on the genesis of silver-lead ores in the Wardner district of Idaho.

Cœur d'Alene, Idaho.—In the *Mining and Engineering World* for June 8, Stuart Rice gives a review of the silver-lead mining operations in the Cœur d'Alene district, Idaho, together with a history of its discovery and development.

verbal long-felt want, and engineers and also those commercially interested will find it of great value as a scientific guide to prospecting for oil. The author is a geologist by training, and at one time was connected with the British Geological Survey. He has had extended experience in the investigation and mapping of oil deposits, and a large proportion of the book is based on his own observations and experience. The book is not too theoretical, and is written in a clear and forcible style, so as to be perfectly intelligible to those who have only a rudimentary knowledge of field-geology.

The author begins by discussing the various theories as to the origin of petroleum, setting forth the arguments pro. and con. in each case, and eliminating each theory by the production of some fact in variance with it, until none is left but that which proffers land



BUBBLE BURSTING AT MUD VOLCANO, MINBU, UPPER BURMA.

Tin-Silver Ores in Bolivia.—The *Mining Journal* for June 15 contains an article by Gilmour E. Brown describing an "unusual zonal arrangement of tin ore in a vein" at an unnamed mine on the southern fringe of the Oruro district, Bolivia.

Radium in Saxony.—The *Mining and Engineering World* for June 15 contains a translation of a pamphlet issued by C. Schiffner on the uranium minerals found in Saxony in relation to their radium contents.

BOOKS REVIEWED

OIL FINDING: AN INTRODUCTION TO THE GEOLOGICAL STUDY OF PETROLEUM. By E. H. Cunningham Craig. Cloth octavo, 200 pages, illustrated. London: Edward Arnold. Price 8s. 6d. For sale by *The Mining Magazine*.

A great deal has been written in various countries about the geology of oil deposits and on the theory of their origin. But most of these writings have appeared in Government and other publications that are not easy of access or purchase. On the other hand, the textbooks on petroleum tell very little of the geology and skip the theory. The present book meets the pro-

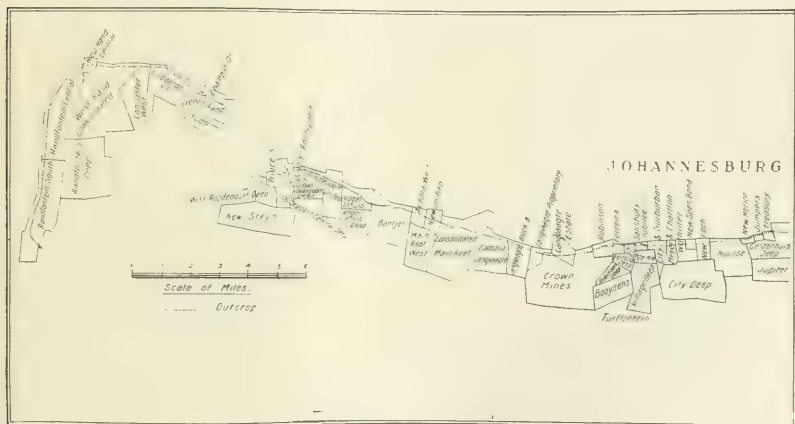
vegetation as the ultimate source and origin. Having proceeded so far, he reviews the processes, chemical and physical, that have effected the change, showing that pressure, temperature, and a small amount of water will account for it; also that variation in these three factors affords an explanation of the wide range of the character of the products. In the latter connection, he urges that there is no hard and fast line between asphaltic and paraffin oils, as is usually assumed. In this chapter he also advances a theory accounting for the association of salt with petroleum. The next section of the book treats of the migration, filtration, and subterranean storage of petroleum. Having thus concluded the theoretical part of the subject, the author proceeds to deal with the actual methods of occurrence, and the surface indications whereby a geologist can locate an oil deposit, describing the various structural relations of the rocks to such deposits and other physiographical phenomena connected therewith. The last two chapters give useful instructions to the beginner, in field work and indoor work. Altogether, as we have already said, the book is a valuable exposition of the subject, and withal eminently readable. E. W.

COMPANY REPORTS

Lancaster West.—This mine is situated in the far west Rand and belongs to the Goerz group. Milling commenced in 1899, and in 1909 the adjoining Lancaster mine was absorbed. A number of 'reefs' are found on this property, where the deposits are not in conformity with the central and eastern parts of the Rand, the Botha and West Battery reefs being the principal ones. The only dividend distributed was a small one in 1903. The report for the year 1911 shows that 298,727 tons was raised, mostly from the Battery Reef, and after the removal of 13% waste, 258,682 tons averaging 5.7 dwt. per ton was sent to the mill. The yield by amalgamation and cyanide was 69,478 oz. worth £293,876, that is, 5.36 dwt. or 22s. 8d. per ton milled. The working cost was £260,655 or 20s. 1d. per ton, leaving a working profit of £33,220 or 2s. 7d.

6.78 dwt. per ton. In addition 2677 oz. was recovered from accumulated slime. The value of the total gold won was £248,746. The working cost was £224,530, leaving a profit of £24,215. The dividend was at the rate of 5% and absorbed £28,751. The ore reserve on December 31 was estimated at 656,500 tons averaging 5½ dwt. At the present time the mill is not running at full capacity and expenses are therefore higher than normal, but the labour force is gradually being increased.

New Unified.—This company belongs to the Barnato group and was formed in 1891 to acquire a property on the outcrop in the middle west Rand. For a number of years the operations were unsuccessful, and dividends were not paid until 1908. The report for 1911 shows that conditions are improving in many ways; the cost has been lowered 1s. per ton, and the extraction increased by 2s. per ton, while the profit,



THE WESTERN HALF OF THE RAND.

per ton. The ore reserve was estimated on December 31 at 472,700 tons averaging 6½ dwt. per ton. The development is expensive owing to the faulting and to the large proportion of unprofitable rock.

Princess Estate.—This gold mine belongs to the Goerz group and is situated at the end of the middle west Rand, at the point where there is a gap between the Princess and the French Rand. The company was formed in 1888, and milling started in 1892. In the spring of 1911 two properties on the dip belonging to the West Roodpoort Deep and Roodpoort Central Deep were acquired and the capital increased from £265,000 to £575,033. Of the new shares 177,333 were paid for the additional property, and 132,700 were subscribed at 27s. 6d. During the year 1911, £159,277 was spent out of capital for the purpose of centralizing the surface plant, putting the shafts in order, and connecting the underground workings, and also in the purchase of the Norman claims. During the same period, 247,105 tons of ore was mined; of this, 17,928 tons of waste was left in the workings, and 62,549 tons removed at the surface, leaving 166,628 tons averaging 7.28 dwt. to go to the mill. The recovery by amalgamation was 35,952 oz., by cyanide 11,960 oz., and from concentrate 8131 oz., making a total of £56,043, or

£53,143, was £19,240 higher than in 1910. Development has given satisfactory results, and the reserve on December 31 was figured at 288,343 tons, estimated to give a yield of 6½ dwt. During the year, 152,497 tons of ore was raised, and after the removal of 20% waste, 122,465 tons averaging 7½ dwt. was sent to the mill. The recovery by amalgamation and cyanide was 42,032 oz., worth £178,429, being an extraction of 6.87 dwt. or 29s. 2d. per ton milled. In addition, a profit of £4948 was made by the treatment of accumulated slime. The dividends absorbed £37,500, being at the rate of 15%, £3534 was paid as tax, and £7113 written off for depreciation.

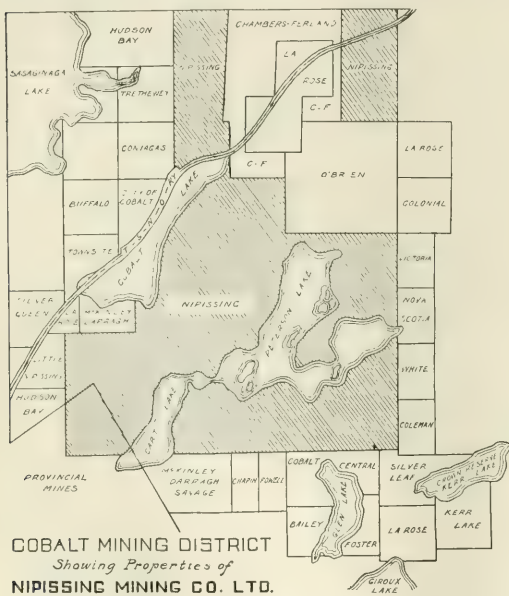
Consolidated Langlaagte.—This company was formed in 1902 by the Barnato group for the purpose of amalgamating the New Croesus and the Langlaagte Star, owning properties 4 miles west of Johannesburg. In the deep levels, the Ferreira-Crown Reef dike has caused an upthrow, and the two sections of the deposit are to be worked by separate shafts. No dividend has yet been paid, but profits have been sufficient to liquidate much of the debenture debt. During the year 1911, the mill of 140 stamps crushed 251,537 tons of ore averaging 6 dwt., and the yield by amalgamation and cyaniding was worth £312,089. The working

profit for the year was £84,667, and £260,714 was carried forward from 1910. Out of the total balance £226,885 has been spent on shaft-sinking and equipment in the deep-level part of the property. This equipment includes 100 new heavy stamps and 10 tube-mills. The development is being actively pushed, and on December 31 the ore reserves in the two parts of the mine were estimated at 1,619,647 tons averaging 6.7 dwt. The consulting engineer, J. G. Lawn, and the manager, A. E. Payne, write in encouraging tones as to the future of the property.

Village Main Reef.—This company was formed in 1888 to acquire property on the dip of the Jubilee and City & Suburban mines in the central Rand. In 1906 the adjoining Wemmer mine was absorbed. Milling

per ton, leaving a working profit of £459,457 or 19s. 4d. per ton. After the payment of taxes and general expenditure, the net profit was £404,196, out of which £330,400 was distributed as dividend, being at the rate of 70%, and the balance carried forward. The mine has suffered from scarcity of native labour, both as regards output and development. During the year, 5233 ft. of development work was done, disclosing 221,554 tons of ore. The estimated ore reserve on December 31 was 1,418,754 tons averaging 8.85 dwt. per ton. This reserve is sufficient to supply the mill for 2½ years, and the ground still undeveloped is expected to yield ore that will prolong the life of the mine for another 2½ years. Some of the funds of the company have been applied for the purchase of Village Deep shares. The debentures have been finally extinguished during the past year.

La Rose Consolidated.—This is one of the pioneer companies at Cobalt, Ontario, and is of equal importance to the Nipissing mentioned in the preceding paragraph. D. Lorne McGibbon is president and R. B. Watson is general manager. The report for 1911 shows that the shipments during the year were as follows: Nuggets 124 tons, containing 274,598 oz. silver; 1771 tons high-grade ore, containing 3,066,489 oz.; 603 tons low-grade silicious ore, containing 112,067 oz.; and 1175 tons concentrate, containing 639,554 oz.; total 3561 tons, containing 4,092,709 oz. silver. The gross silver value was \$2,191,524, and from this \$187,815 was deducted for treatment, freight, sampling, etc. The cost of mining and administration was \$520,863, bringing the total expenses to \$708,678. The dividend distributed absorbed \$599,450, and \$951,970 is kept in hand. The holding of this large balance is due to the adoption of a policy (not favoured by some members of the board since resigned) of creating a fund for other investments, and of "making the company a permanent organization for the profitable development of new properties." The total dividends distributed to date have been \$3,719,862. Mr. Watson reports favourably on the developments at the mine, and estimates the reserve on December 31 at 1883 tons



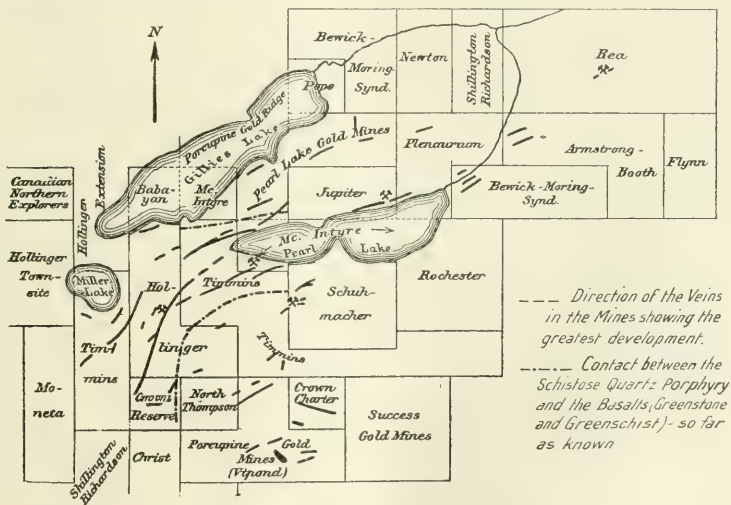
commenced in 1892, and a new plant was provided in 1898 consisting of 100 stamps; 60 more stamps were added in 1899, and 60 acquired from the Wemmer. The company is housed with the Consolidated Gold Fields, but the technical control is with the Rand Mines. During the year 1911, the amount of ore mined was 568,238 tons, and after the removal of 16½% waste, 474,135 tons was sent to the mill. The average assay-value of the ore milled was 9½ dwt.; in this connection it is of interest to remind readers that it was at this mine that H. F. Marriott's policy of rigidly excluding waste from the ore mined was first adopted. The yield by amalgamation was 143,250 oz. and by cyanide 68,712 oz., making a total of 211,962 oz., or 8.9 dwt. per ton milled. The value of the gold recovered was £889,043, or 37s. 4d. per ton milled. The working cost was £429,585 or 18s.

of high-grade ore containing 2,206,358 oz., and 94,031 tons of milling ore containing 2,044,503 oz.

Nipissing.—This is the largest producer of silver among the mines at Cobalt, Ontario. The report for 1911 shows the output and profits to be rather lower than those of 1910 as reported in our issue of July last year. The most important event of 1911 was the provision of plant to treat all the ore on the spot, as already recorded in our columns, and recapitulated below. During the year the shipments to smelters were as follows: high-grade ore 736 tons averaging 2393 oz. silver per ton; low-grade silicious ore 1859 tons averaging 273 oz.; concentrate 243 tons averaging 1000 oz.; the total silver content was 2,512,950 oz. In addition silver bullion containing 2,371,979 oz. was produced and sold, and 50,565 oz. silver was recovered from Nipissing ore milled by the Nova Scotia plant.

Some of the ore treated by the Nipissing plant was purchased from other mines, and the yield from this source was 257,421 oz. silver, so that the actual yield from the Nipissing properties was 4,678,074 oz. The gross value of the silver was \$2,819,668, and in addition 2356 lb. of cobalt brought in \$589. The smelters' deduction on silver was \$63,085, and treatment charge \$33,011; in addition \$34,536 was paid as freight, and \$6615 as commissions. The mining and milling cost was \$523,419, and the total cost of production was \$725,015 or 14 cents per ounce of silver. The profit was \$2,095,241 or 40 cents per ounce. The dividend absorbed \$1,800,000, being at the rate of 30%. During 1910 the yield was 5,597,778 oz., the profit \$2,167,103, and the dividend \$2,100,000. As compared with 1910 the results for 1911 show a larger profit per ounce, a fact due to the establishment of the new metallurgical plant. Comparatively little surface prospecting was done during 1911, as trenching had been abandoned

method of treatment adopted is to all-slime and amalgamate, without any cyanidation, and the crushing plant consists of Sturtevant rolls, and Hardinge ball-mills and tube-mills. The outcrops of 27 veins have been traced, but work is confined to Nos. 2 and 3. The chief development is centred on the 100-ft. and 200-ft. levels from the main shaft. The principal veins are found in a shear-zone of amygdaloidal basalt, altered to a hornblende and in some places to a sericite schist. The crushing and shearing has opened a series of channels along which the depositing solutions travelled. This shear-zone is thus a mass of fine stringers, and along certain well defined lines much larger orebodies have been formed. Another result has been to dissolve the calcite and carbonates of iron and magnesium which fill the amygdules and re-deposit the material as stringers through the fracture planes. No. 3 vein on the 100-ft. level is 25 ft. wide and assays \$12 per ton on the average.



THE PEARL LAKE DISTRICT, PORCUPINE, ONTARIO.

for hydraulic stripping, and owing to the non-delivery of the new plant required little could be done in this direction. On the other hand much underground development work was done with gratifying results, and the ore reserve is a year ahead of the mill. The new plan of treatment as mentioned above is to amalgamate the high-grade ore in a tube-mill in a cyanide solution. In this way 97% of the silver content is recovered as amalgam. A mill is being built to treat 200 tons per day of low-grade ore, by all-sliming and cyaniding. These new processes have been devised by Charles Butters & Co.

Vipond.—The property of the Vipond Porcupine Gold Mines Co. consists of four claims situated to the south of Pearl lake and near the Hollinger. Work has been continuous since April 1910. A Nissen stamp erected in February 1911 was destroyed by the fire in July, and a new plant is now in course of erection. The

St. John del Rey.—The production of gold at this mine in Minas Geraes, Brazil, for the year ended February 29 last was the largest obtained in any year since the company commenced operations in 1834. This, together with the fact that the workings are now down 4600 ft. from adit or 4900 ft. below the surface in profitable ore, serves to remind us that the St. John del Rey is one of the wonderful mines of the world. The report for the year under review shows that 196,310 tons of ore was raised, and after the rejection of 2% waste, 192,600 tons was sent to the 130 stamps. The total yield was £442,142, or 45s. 10d. per ton, of which 29s. 9d. was recovered by amalgamation and 16s. 1d. by cyanide. The working cost, including development, London expenses, and taxes in Brazil, was £301,753, or 31s. 3d. per ton. In addition, £24,794 has been transferred to capital expenditure account, £2891 paid as directors' percentage, £7615 as English income tax.

£36,275 in redemption of mortgage debentures, and £450 as interest on debentures. The preference shareholders receive the usual 10%, absorbing £10,000, and the ordinary shareholders £54,626, being at the rate of 10%. The tunnel, 1100 ft. long, on Horizon No. 16, connecting the bottom of 'F' shaft to the top of the proposed 'G' shaft, has been completed, and the winding engines will shortly be installed when the plat is ready. The sinking of 'G' shaft will then be begun, and it should be down 600 ft. to Horizon No. 18 early next year. It is intended to sink it eventually another 600 ft. to Horizon No. 20, 5800 ft. below adit or 6100 ft. below surface, provided the lode continues profitable. At present Horizon No. 17 is the deepest working. The ore reserve on February 29 was estimated at over 1,000,000 tons, sufficient to keep the mill employed for 5 years. The change from steam to electric power is being gradually effected, and a second unit of electrical plant for the Peixe river hydro-electric station has been dispatched. The improvements in ventilation and the consequent reduction of temperature in the lower workings are described in our Précis of Technology. The directors, recognizing the invaluable and long-continued services of George Chalmers as manager, have recommended that a special honorarium of 2000 guineas be paid to him.

Consolidated Gold Fields of New Zealand.—This company was formed in 1896 to acquire the Wealth of Nations gold mine at Reefton, New Zealand, from David Ziman. In the same year, the Progress company was floated as a subsidiary, and in 1906 the Blackwater company was introduced in the same way. Small dividends have been paid regularly since 1899. The report now published covers the year 1911, and shows that the output and results of development have improved at the Wealth of Nations mine. The mill treated 24,968 tons of ore, yielding bullion worth £50,374, or 40s. 4d. per ton. The working expense was £23,022, or 18s. 5d. per ton, leaving a working profit of £27,352, or 21s. 11d. per ton. The administration expenses were £3988, and £1232 was paid as taxes, while £20,134 was allowed for depreciation. The income was swelled by £14,629, received as dividends from the Blackwater company, and £2002 was received as interest on loans. The net profit was £19,811, out of which £12,118 was paid as dividend on the ordinary shares, being at the rate of 5%, and £2019 was paid as dividend on the founder's share. The latter share is entitled to one-quarter of the divisible profits after 100% has been distributed on the ordinary shares. During the year, 3752 ft. of development was done, and on December 31 the ore reserve was estimated at 34,296 tons averaging 11 dw. In addition, 11,886 tons of partly developed ore averaging 13½ dw. is reported. A. Winter Evans was appointed manager of this group of mines in June last.

Progress Mines of New Zealand.—Particulars of this company are included in the above paragraph. The report for 1911 shows that the present prospects are not particularly bright, owing to the faulted nature of the ground and the consequent loss of the lode. It has been necessary to do a large amount of exploration work, the total being 5017 ft. During the year, the mill treated 41,596 tons of ore, yielding gold worth £48,014; these figures were 8606 tons and £25,483 less than during 1910. The working cost in New Zealand was £62,957, and it has been necessary to write off £10,494 for shaft-sinking and development, and £4627 for depreciation. The sum of £13,019 was received as dividend on shares held in the Blackwater company. The debit balance at the end of the year

was £17,242. The company has done fairly well hitherto, for some years paying 12½%, and a total of 113½%. Mr. Winter Evans writes hopefully of the prospects of finding further ore, and in fact the reports forwarded since the end of the year have shown a distinct improvement in the position.

Blackwater.—This member of the Consolidated Gold Fields of New Zealand group is promising to be the most profitable. Dividends were first paid in 1909, and already 35% has been distributed. During the year 1911, the amount of ore treated was 44,038 tons, and the yield was worth £97,982. The working cost in New Zealand and London was £48,578. In addition, £1994 was written off for depreciation, £1000 was placed to gold reserve, £10,000 to development and prospecting, and £3035 was paid as taxes. The net profit was £26,744, and £37,498 was paid as dividend, some of the funds coming from the balance brought forward from 1911, the rate of distribution being 15%. The amount of development done was 5768 ft. and on December 31 the reserve was calculated at 70,979 tons averaging 10½ dw. over 26 inches, in addition to which 29,390 tons is reported as possible ore averaging 10 dw. over 26 inches. This mine, as with others of the group, has been greatly hampered recently by labour troubles.

Taliman Consolidated.—This company was formed in 1899 for the purpose of acquiring gold-mining properties near Karangahake, in the province of Auckland, New Zealand. Reconstruction took place in 1904, when the Woodstock mine was acquired. The consulting engineers are Bewick, Moreing & Co., and H. Stansfield is manager. Dividends were first paid in 1906, and the rate has steadily increased. The report for the twelve months ended February 29 shows that 47,920 tons of ore was milled, and that the gold-silver bullion and concentrate produced contained 53,936 oz. gold and 207,612 oz. silver, yielding an income of £236,244. The working profit was £134,062, out of which £9322 was paid as taxes, and £11,208 was written off for depreciation. The dividends absorbed £119,898, being at the rate of 35%. The development work during the year totalled 3219 ft. and disclosed 55,000 tons of ore. The reserve on February 29 was estimated at 56,791 tons averaging £6. 3s. 3d. per ton. In addition probable ore is reported to the amount of 42,014 tons averaging £5. 15s. 6d. per ton. The sum of £40,000 has been accumulated as a special reserve fund to be used at a convenient time for additional development work. Since September last the concentrate has been treated on the spot instead of being sold to European smelters.

Zinc Corporation.—As recorded in our issue of July 1911, this company was formed in London on July 8 to consolidate the Zinc Corporation and Broken Hill South Blocks, two companies registered in Victoria, Australia. As is well known, the former company had been treating zinc tailing at Broken Hill since 1905 and producing zinc and lead concentrates, at first by the Elmore vacuum plant, and since the end of 1910 by the Minerals Separation process. The South Blocks company owned a mine containing two lodes, one of which is higher in zinc than lead. The issued capital of the new company is 245,692 preference shares of £1 each, and 653,139 ordinary shares of 10s. each. Of these, 179,026 preference shares and 453,132 ordinary shares were allotted to the shareholders in the old Zinc Corporation, and 66,666 preference shares and 200,000 ordinary shares to the shareholders in the South Blocks. The report now issued covers the 5½ months from the date of registration to the end of 1911. It was desirable to make the

company's financial year coincide with the calendar year, as the final settlement of zinc prices is made on the basis of the average price during a calendar year. Special arrangements have had to be made on this occasion to enable a dividend to be paid on the ordinary shares for the short period under review. During this period, 140,370 tons of tailing drawn from eight separate dumps was treated in the flotation plant, and the yield was 42,350 tons of zinc concentrate assaying 45.3% zinc, 7.7% lead, and 13.9 oz. silver; and 3865 tons of lead concentrate assaying 55.3% lead, 16.4% zinc, and 34.4 oz. silver. In addition, 3988 tons of slime assaying 38.6% zinc, 13.2% lead, and 23.4 oz. silver has been dumped for further treatment. At the mine, 64,313 tons of ore was raised and treated in the lead mill, yielding 11,846 tons of lead concentrate, averaging 64.9% lead and 8.7 oz. silver; also 16,315 tons of zinc tailing, which was sent to the flotation plant. The income from the sale of concentrates and sulphuric acid was £235,661, this being subject to adjustment when the average price of zinc during 1912 has been ascertained, and the net divisible profit was £73,243. Accompanying the directors' report is one by Theodore J. Hoover, who recently made an examination of the mine and the plant. He estimates the ore reserve at the mine at 665,000 tons, averaging 14.6% lead, 9.4% zinc, and 2.3 oz. silver. This does not include the lode preponderating in zinc, which has not been sufficiently developed to warrant an exact estimate, though Mr. Hoover gives a preliminary estimate of 300,000 tons averaging 19% zinc, 8.5% lead, and 1.5 oz. silver. He also describes in detail the nature of the 2,143,000 tons of dump material remaining to be treated, and outlines a general prospective policy for the company.

Great Boulder Proprietary.—The end of this company, operating the gold mine at Kalgoolie, appears to be within measurable distance, for the main orebody has passed out of the boundary into that of the Golden Horse-Shoe between the 2650 and 2800-ft. levels, and the prospecting and development during the past year in other parts of the property have not been promising. The ore reserve on December 31 was estimated by Richard Hamilton, the manager, at 698,662 long tons, averaging 14½ dwt., which should provide another million pounds in dividends spread over four years. The report for 1911 shows that 187,510 long tons of ore was raised and treated, yielding 158,351 oz. bullion, worth £567,639. The working profit was £306,829, out of which £29,855 was paid as taxes, £14,000 written off for depreciation, and £262,500 distributed as dividend, being at the rate of 150%. This company has hitherto been a most regular producer. The first year, 1895, yielded gold worth £107,023, and during the next seven years the output steadily grew. From 1903 onward the yearly production has been practically constant.

Great Fingall Consolidated.—This company was formed in 1899 to amalgamate a number of properties at Day Dawn, near Cue, Western Australia. Bewick, Moreing & Co. are the managers. From 1901 to 1908 handsome dividends were paid, but afterward the grade of ore decreased. Further prospecting at depth revealed the presence of a profitable orebody, and an internal shaft is now being sunk in its vicinity in order to provide for its development. During the year 1911, forty of the hundred stamps were at work, and treated 101,949 tons, which yielded 28,123 oz. gold. In addition 8664 oz. was obtained from accumulated sand and slime, and 6030 oz. from custom ore purchased. The net profit was £19,116, out of which £12,500 was distributed as dividend, being at the rate of 10%, and

£3300 written off for depreciation. The ore reserve in the upper part of the mine above the 14th level was estimated on December 31 last at 52,926 tons, but there is also an unknown quantity of ore left in the old stops that cannot at present be reached. Below the 14th level the reserve amounts to 31,812 tons averaging 42s. 10d. per ton, but this cannot be mined until the auxiliary shaft is completed. At the present time about 5000 tons of ore is being sent to the mill per month.

Abosso.—This gold mine in West Africa was first introduced in London in 1888, conjointly with the Taquah mine, the two being owned by the Taquah & Abosso Co. In 1901 the two mines were handed over to separate companies, named after each mine. The Abosso has paid dividends since 1905. The publication of the report for the year ended June 30, 1911, has been delayed owing to the directors desiring to communicate news relating to a proposed amalgamation with other interests. The scheme however fell through. The report shows that during the year, 68,746 tons of ore was raised, yielding 31,950 oz. gold, or 9.29 dwt. per ton, worth £135,616, or 39s. 5d. per ton. The working profit was £20,322, out of which £12,342 was allowed for depreciation, £2958 written off shaft-sinking expenditure, and £2865 paid as taxes. A dividend of £20,000 at the rate of 5%, was paid out of profits brought forward from the previous year. The reserve on June 30, 1911, was calculated at 213,997 tons of fully developed ore averaging 47s., 22,653 tons of partly developed ore averaging 48s. 9d., 46,540 tons of probable ore averaging 38s. 9d., and 14,939 tons in pillars averaging 43s., making a total of 298,129 tons. Much time and money have recently been spent in overhauling the mine and plant, owing largely to the decay of the timber employed. A new battery of 50 stamps is being built, and of these 20 are at work. The directors append further information as to the progress during the 10 months ended April 30 of this year. The ore crushed amounted to 72,835 tons yielding 31,550 oz. gold, or 8½ dwt. per ton, worth £133,835, or 36s. 9d. per ton. On April 30 the total ore reserve was estimated at 299,400 tons. Sinking of the main shaft has been resumed, and it is now down 1590 ft. on the incline. Preparations are being made for the opening of the 12th level at 1585 ft. The working cost has been substantially reduced lately. For the year ended June 30, 1911, the cost averaged 34s. 7d. per ton, and for April of this year it was only 25s. 11d. Two years ago, W. R. Feldtmann was appointed consulting engineer and J. W. Newbery manager. The former has since resigned. The capital expenditure authorized at the end of 1909 when £100,000 was subscribed is about completed and the company is now on a sound basis once more and the mine well equipped.

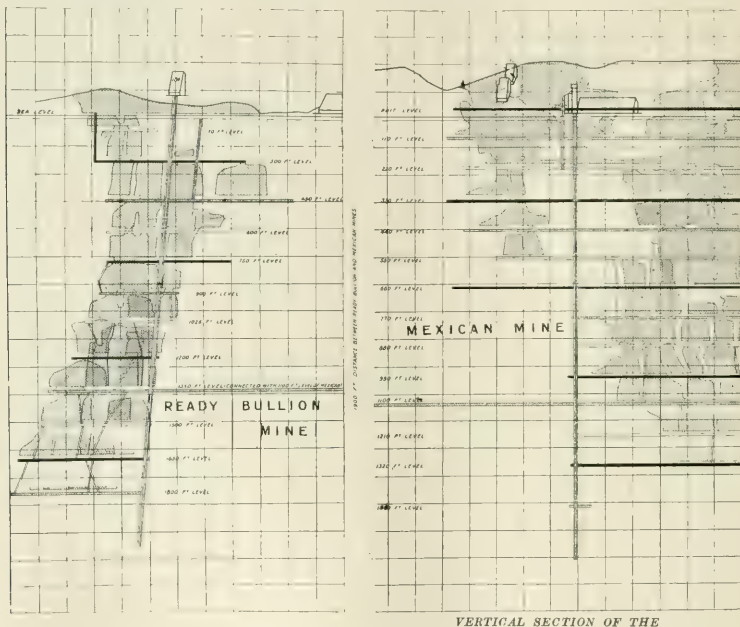
Taquah.—Particulars of this company are given in the foregoing paragraph. The only dividend paid was for the year 1908-9. Additional capital to the extent of £150,000 was provided in 1909 for the purpose of overhauling the plant and pressing forward developments. Milling was suspended from July 1910 to July 1911. The report for the year ended June 30, 1911, shows that during the short time the mill was running, 12,387 tons of ore yielded 6795 oz. gold worth £28,819, being an extraction of 11 dwt. or 46s. 6d. per ton. In July 1911, 20 stamps were started, and another 10 on March 1 last. From the resumption of milling to April 30 last, 32,795 tons of ore yielded 23,178 oz. gold, being an extraction of 14½ dwt. or 59s. 11d. per ton. The reserve on June 30, 1911, was estimated at 95,799 tons of fully developed ore averaging 77s. per ton, and 16,000 tons of partly developed ore averaging 68s.

per ton. On April 30 of this year the reserve was 166,700 tons. The main shaft is now down 2186 ft. The financial results for the year ended June 30, 1911, show an excess of expenditure over receipts of £25,679. This does not include expenses paid out of the new capital subscribed two years ago.

Alaska Treadwell.—The financial year of this gold mine on Douglas island, Alaska, has been altered so as to end with December 31, so that the period covered by the present report extends from May 16, 1910, to December 31, 1911. During this time 1,349,264 tons of ore was sent to the mills. The largest proportion came from the 1050, 1250, and 1450-ft. levels, but

\$2.49 per ton. The new steam-power plant at the mine has been completed, as also has the hydro-electric power plant at Sheep creek. Plans have been made for another hydro-electric station at Nugget creek, 14 miles away. The scheme for hoisting all the ore from the Treadwell, 700 Foot, and Mexican mines from the main shaft of the 700 Foot mine is now in hand.

Alaska United.—This company operates the Ready Bullion and 700 Foot mines, which are separated by the Mexican, as shown in the accompanying section. It is to be noted that a length of unprofitable lode of 1900 ft. is omitted between the two parts of the illus-



VERTICAL SECTION OF THE

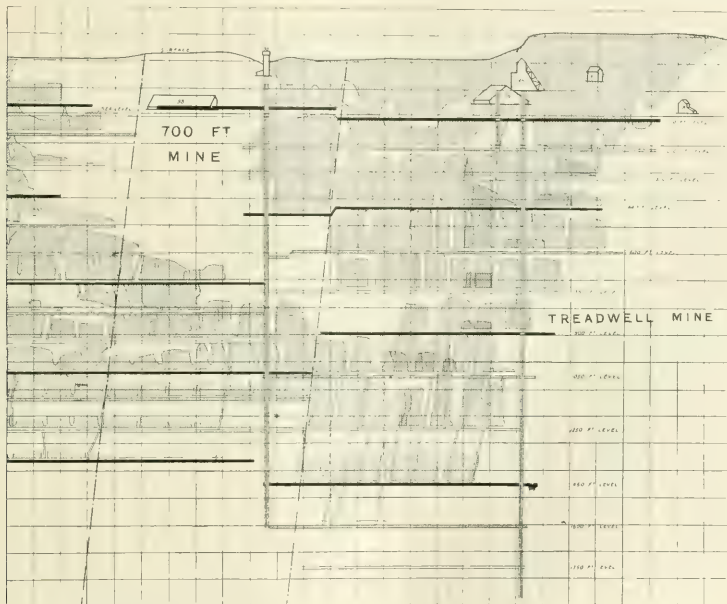
some development ore from the 1600 and 1750-ft. levels was also treated. Until May 16, 1911, the concentrate continued to be shipped to the Tacoma smelter, and since then it has been cyanided on the spot. At the 240-stamp mill, 633,976 tons was crushed, and at the 300-stamp mill 715,288 tons. The total yield was \$1,880,627 in free gold, and \$1,378,818 from the concentrate, making a total extraction of \$3,259,446, or \$2.4157 per ton. Other income brought the total receipts to \$3,399,478, or \$2.5195 per ton. The working cost was \$1,937,349, or \$1.4358 per ton, and the working profit \$1,462,129, or \$1.0837 per ton. The amount of \$375,000 was allowed for depreciation and \$800,000 was distributed as dividend, being at the rate of \$4 per \$25 share for 19 months. During the period, 15,533 ft. of development work was done, and the reserve, including pillars, on December 31 last was 7,613,087 tons, estimated to contain an average of

tration. The report now issued covers 12½ months to December 31 last. At the Ready Bullion mine, 223,668 tons of ore was mined and milled, most of which came from the 1350, 1500, and 1650-ft. levels, together with some development ore from the 1800-ft. level. The yield by amalgamation was \$278,034, and from the sulphide concentrate \$241,248, making a total of \$519,283, or \$2.3217 per ton. At the 700 Foot, 215,666 tons of ore was treated, yielding \$217,634 by amalgamation, and \$232,823 from the concentrate, a total of \$504,457, or \$2.3391 per ton. Including small items, the revenue was \$1,053,742, and the operating profit \$321,414, out of which \$81,090 was paid as dividend, being at the rate of 9%, and \$195,000 was written off for depreciation. The ore reserve at the Ready Bullion on December 31 was 1,448,108 tons, and at the 700 Foot, 1,387,076 tons. Twenty new stamps started at the 700 Foot in July 1911, making

120 in all. There are also 120 stamps at the Ready Bullion.

Alaska Mexican.—The report now issued covers 12½ months ended December 31 last. During this time, 227,081 tons of ore was raised and treated, the largest proportion coming from the 1100 and 1210-ft. levels, together with some development ore from the 1320-ft. level. The mill of 120 stamps extracted \$336,761 by amalgamation, and \$364,813 was obtained from the sulphide concentrate, making \$701,574 in all, or \$2 9679 per ton. The working profit was \$257,880, or \$1 09 per ton; \$100,000 was written off for depreciation, and \$126,000 was distributed as dividend, being

policy is that the properties are now worked in two groups, the Anaconda and Butte & Boston respectively, instead of in four groups as arranged when the amalgamation was effected. The total amount of ore raised was 3,844,070 tons, in addition to which 4602 tons of precipitate was obtained. This, together with 499,077 tons of purchased ore, was treated at Anaconda and Great Falls, and the total production was 115,000 tons copper, 9,731,561 oz. silver, and 48,949 oz. gold. The mining cost was \$14,493,824, the smelting cost \$7,744,570, and transport charges \$4,664,946. The sales, less cost of ore purchased, were \$35,291,740, and after certain rents and interest had been credited,



ALASKA TREADWELL GROUP.

at the rate of 14%. The ore reserve on December 31 was 980,025 tons. F. W. Bradley is now president of the Alaska group of mines on Douglas Island, and Robert A. Kinzie is superintendent.

Anaconda Copper.—In March 1910 the Anaconda company of Butte, Montana, absorbed the neighbouring Boston-Montana, Washoe, Butte & Boston, and Parrot, and the capital was increased to 4,332,500 shares of \$25 each. Subsequently other property was purchased from W. A. Clark. The object of the deals was chiefly to get rid of long-continued disputes as to the ownership of several orebodies. The report for 1911 shows that, owing to the low price of copper, production was kept below the capacity of the mining plant, though development was maintained; but the output shows an increase on the year before, when the many new improvements had not been completed. Another item of interest in connection with the general

and cost of administration paid, the net profit was \$8,043,718. The dividends absorbed \$8,608,750.

Poderosa.—This company was formed in 1908 to acquire from local owners the group of copper mines of this name, situated in the Collahuasi district of Chile, not far from the Bolivian border. The management of the properties was placed in the hands of Robert Hawxhurst, who was subsequently succeeded by C. H. Macnutt. The former described the orebodies and the general conditions in an article in the magazine for October 1910. Results have been disappointing owing to the many difficulties of working and to the unsatisfactory nature of the orebodies. The altitude, 15,000 ft., the climate, the cost of transport and scarcity of supplies, all have combined to hinder energetic operations. The report for 1911 now published shows that the flooding of the mine in March of that year seriously interfered with work, and the pro-

vision of additional pumps was a tedious affair. In addition the wet and the winter seasons were both unusually severe and long, and their effects on the health of the men and on the condition of the mine were disastrous. Not only did the production fall, but the cost was increased. The amount of ore exposed was disappointing, and a large proportion of the output came from the auxiliary veins which at best are narrow and irregular. During the year 18,357 long tons of ore was raised, of which 15,577 tons came from the Poderosa and the remainder from the San Carlos and Rosario. The average assay was 17.3% copper. In addition 27,776 tons averaging 3% copper was raised and placed on the dump for future concentration. The shipments were 13,392 tons averaging 22% copper and

most satisfactory manner. The Jibutil was acquired by the Nunddyroog company and floated as a separate company, the Jibutil Gold Mines of Anantapur. The Anantapur Goldfield is now centring operations on the exploration of the Ramagiri block. A shaft is being sunk close to some of the largest old workings in the district, and it should be possible to start a level at 200 ft. sometime during the autumn. The report of the company for the 12 months ended March 31 shows that £54,000 in Jibutil shares was distributed as a dividend, being 90% on the capital. The company continues to hold £10,927 in Jibutil shares, and £16,169 in shares in the North Anantapur.

TRADE NOTES

Most of the trade publications mentioned in this column are available for distribution and the manager of The Mining Magazine will be pleased to secure copies for persons interested.

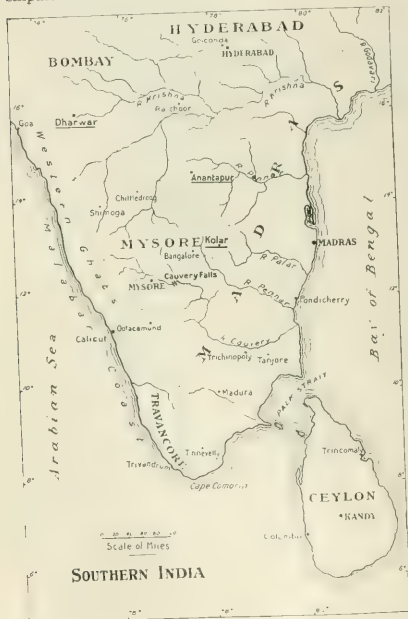
The Bucyrus Company have established a London office at Caxton House, Westminster. We are in receipt of their small pamphlet briefly outlining the various types of steam and electric shovels also dredges for harbour and placer work. We have before reviewed the larger and more comprehensive catalogues in this column.

The Goulds Manufacturing Co. issue their bulletins in loose-leaf form and supply a substantial binder for keeping the various editions together. This method of issuing trade announcements is convenient for the engineer. The Goulds Manufacturing Co. are pump specialists. They are represented in London by Gillespie & Beales.

Arthur R. Brown describes in pamphlet form an improved alluvial hand and power washing machine. The special features are the lessened height of feed hopper and the special jiggling action. The material not only passes over two jiggling boxes but also over a stationary sluice-box giving a larger area for gold-saving. The machine can be worked by man-power or with a horse-gear. It is adapted for working small areas which would not warrant the installation of extensive dredging plant.

Fraser & Chalmers are distributing two new and timely bulletins. Series M, Section 20 deals with machinery and appliances necessary for prospecting for, recovering, and dressing alluvial tin. Section 10 goes fully into the subject of dredging plant. Fraser & Chalmers have been for several years past investigating dredging practice in all parts of the world and are now prepared to turn out dredges with the same excellent workmanship and design which has made their reputation in all other branches of Mining Machinery.

Jens Orten-Boving & Co. report the following recent orders for Victoria Turbo Pumps: Montreal Water & Power Co. (repeat order) for 2 pumps, each to deliver 7000 g.p.m. against a head of 455 feet at 1260 r.p.m., each pump being coupled to a 1400 B.H.P. motor. Berrida Tinfields, Ltd., pump to deliver 1900 g.p.m. against a head of 103 feet at 600 r.p.m. Great Western Colliery, South Wales, pump to deliver 417 g.p.m. against 112 ft. head at 1450 r.p.m. Goss Moor Tin Alluvials Co., Ltd., pump to deliver 3130 g.p.m. against 112 ft. head at 580 r.p.m. Four 600 g.p.m. pumps for the city of Moose Jaw, Canada, and others for the Tanaka Gold Mine, Japan; and the Lothian Coal Co. At Cobalt one of these pumps throwing 4800 g.p.m. is being used for prospecting the Nipissing hill



7½ oz. silver; this was sent by rail to the port of Mejillones, whence it was forwarded partly to America and partly to Europe. The ore reserve on December 31 was calculated by Mr. Macnutt at 21,000 tons averaging 22% copper, mostly at the Poderosa and San Carlos. In addition there is 110,000 tons on the dump averaging 4½% copper. The net proceeds from the sale of ore was £112,707. The mining expense was £105,947, and £19,649 was allowed for depreciation. The loss for the year was £16,995, which brings the debit balance to £47,033.

Anantapur Goldfield.—This company was formed in 1906 by John Taylor & Sons to acquire three properties in the district of Anantapur, Madras Presidency India, named the Jibutil, Ramagiri, and Dod Buruju. The last named was handed over to a subsidiary, the North Anantapur Gold Mines, and is developing in a

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Scientia non habet inimicum nisi ignorantem.

T. A. RICKARD, Editor.

EDGAR RICKARD, Business Manager.

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C O N T E N T S.

	PAGE		PAGE
STATISTICS OF PRODUCTION.....	80	DISCUSSION	
REVIEW OF MINING.....	81	Mining at Bendigo.....	
EDITORIAL		..... M. W. von Bernewitz	135
Notes.....	87	Early Days at Kalgoorlie.....	
Directors' Fees.....	89	..... H. E. West	135
Gold Mining in West Africa.....	90	Phantom Profits.....	
M.I.M.M. or M.I.C.E.?	91	Edward Walker, W. H. Goodchild,	
Tropical Diseases	92	W. H. Trewartha-James, W. R.	
Eldorado Banket	93	Feldtmann	136
Institutes and Institutions.....	94	Professors and Business.....	
Mining in China.....	95	..... Albert R. Ledoux	141
Institutes as Publishers.....	95	Randfontein Central... W. R. T. Frank	141
Pretea.....	97	PERSONAL	142
METAL MARKETS.....	98	PRÉCIS OF TECHNOLOGY	
SPECIAL CORRESPONDENCE		Alumina in Copper Slags.....	143
Lima	99	Silver - Lead Deposits of British	
Vancouver	100	Columbia	143
New York	103	Preservation of Mine Timbers.....	144
Johannesburg	106	Reinforcing Timbers with Wire-Rope	144
San Francisco.....	109	Ferro-concrete Shaft-linings.....	144
Kalgoorlie	112	The Churn Drill in Shaft-Sinking.....	146
Camborne.....	113	Effect of Arsenates in Cyanidation....	146
Melbourne.....	115	Ammonium Sulphate.....	146
Auckland	118	Subsidence-Shocks on the Rand.....	147
ARTICLES		Estimation of Lead in Smelter Gases	147
British Columbian Minerals.....		Artificial Rubies.....	148
..... E. Jacobs	119	Dry Concentration of Placer Gold.....	148
A Tailing Plant.... Charles A. Banks	121	CURRENT LITERATURE.....	149
An Excursion in Cornwall.....		BOOKS REVIEWED	150
..... Edgar Rickard	126	COMPANY REPORTS.....	151
The Engineer in the Tropics.....		TRADE NOTES	158
..... T. Lane Carter	129		

STATISTICS

STOCKS OF COPPER IN ENGLAND AND THE CONTINENT.
Reported by Henry R. Merton & Co. Tons of 2240 lb.

	May 31. Tons	June 30 Tons	July 31 Tons
In England	30,629	28,633	28,640
In France	5,297	5,485	7,476
Adopt from Chile	1,800	1,475	2,900
Adopt from Australia	6,900	6,000	6,000
In Rotterdam	1,750	1,350	750
In Hamburg	6,252	5,195	4,828

Total European visible supply

AMERICAN COPPER PRODUCERS' ASSOCIATION'S FIGURES.
In Tons of 2240 lb.

	Production.	Domestic	Deliveries	Stocks at end of month
			Foreign	Total
October 1911.	52,792	28,602	26,832	55,425
November	49,945	30,375	29,942	60,307
December	54,865	29,459	35,374	64,833

Total, 1911.....

	Production.	Domestic	Deliveries	Stocks at end of month
			Foreign	Total
January 1912.....	53,272	27,832	35,789	63,621
February	51,801	25,101	28,191	53,292
March	56,114	30,128	26,241	56,369
April	56,011	31,033	33,773	54,806
May	56,570	32,456	31,020	63,476
June	54,605	29,521	27,434	56,955
July	61,233	31,738	26,840	58,578

PRODUCTION OF GOLD IN THE TRANSVAAL.

	Rand	Else-where	Total	Value
	Oz.	Oz.	Oz.	£
July 1911	679,881	29,377	709,258	3,012,738
August	682,405	31,002	713,407	3,030,360
September	669,773	30,852	700,625	2,976,065
October	677,923	30,721	708,644	3,010,130
November	291,466	28,267	319,729	3,057,213
December	680,782	29,126	709,908	3,015,499

Totals, 1911.....

	Rand	Else-where	Total	Value
	Oz.	Oz.	Oz.	£
January 1912.....	709,280	27,780	737,060	3,130,830
February	674,900	28,906	703,806	2,989,832
March	796,755	33,968	830,723	3,538,688
April	706,763	30,897	737,660	3,133,383
May	746,948	32,714	799,662	3,311,794
June	722,588	31,348	753,936	3,202,517
July	732,941	30,397	763,338	3,255,198

* Including 70,143 oz. worth £29,946 extinguished reserve.

COST AND PROFIT ON THE RAND

	Tons	Yield per ton	Costs per ton	Profit per ton	Total profit
		s. d.	s. d.	s. d.	£
1911.....	23,888,260	27 7	18 0	9 7	11,414,863
January 1912.....	2,067,161	27 6	18 10	8 11	997,557
February	1,980,396	28 5	19 2	9 2	907,192
March	2,163,998	28 1	18 11	9 0	1,204,764
April	2,059,562	28 6	19 0	9 8	1,005,920
May	2,177,348	28 6	18 9	9 10	1,073,534
June	2,110,657	28 5	18 6	10 1	1,063,634

NATIVES EMPLOYED IN THE TRANSVAAL MINES.

	Gold mines	Coal mines	Diamond mines	Total
July 31, 1912.....	181,582	8,122	11,054	200,758
August 31.....	179,810	8,182	11,292	199,284
September 30	179,619	8,045	11,475	199,139
October 31	179,199	8,078	11,319	198,591
November 30	176,716	8,044	10,971	194,850
December 31	178,282	8,053	10,914	195,249
January 31, 1912.....	184,046	7,895	9,524	201,475
February 29	190,531	7,912	10,789	209,301
March 31	196,748	8,198	12,011	217,017
April 30	197,907	8,363	13,785	220,080
May 31	193,829	8,460	14,538	216,827
June 30	188,494	8,549	15,530	212,573
July 31	182,976	8,367	15,588	207,256

GOLD OUTPUT OF INDIA.

Year 1910	Year 1911	July 1912	Year 1912
£2,104,858	£2,150,050	£189,801	£1,304,183
PRODUCTION OF GOLD IN RHODESIA.			
MONTH.	1908	1909	1910
January	£199,388	£204,666	£227,511
February	191,635	192,497	203,888
March	200,015	202,157	228,385
April	212,945	222,700	228,213
May	223,867	225,032	224,888
June	224,920	217,600	214,709
July	228,151	225,234	195,233
August	230,792	228,296	191,423
September	204,262	213,249	178,950
October	205,466	222,653	234,928
November	196,668	236,307	240,573
December	217,316	233,397	199,500

Totals

PRODUCTION OF GOLD IN WEST AFRICA.

MONTH.	1910	1911	1912
	Oz. Value	Oz. Value	Oz. Value
January	17,357 £70,699	15,903 £66,107	26,098 £107,262
February	16,976 £68,469	15,179 £61,081	25,009 £102,270
March	17,627 £71,954	16,387 £67,671	27,228 £111,376
April	16,363 £67,069	17,437 £70,880	27,790 £114,796
May	16,590 £68,355	24,427 £96,409	28,015 £115,678
June	17,194 £70,988	22,555 £92,174	27,784 £114,697
July	15,564 £58,551	22,510 £91,955	—
August	13,921 £57,713	25,385 £103,753	—
September	11,497 £47,746	26,717 £109,039	—
October	13,341 £55,046	26,826 £109,503	—
November	14,021 £57,658	24,289 £99,249	—
December	15,042 £61,737	24,369 £99,569	—

185,493 755,985 261,784 1,069,442

PRODUCTION OF GOLD IN WESTERN AUSTRALIA.

	Export oz.	Mint oz.	Total oz.	Total value
Total, 1910	363,496	1,209,856	1,573,352	6,682,042
Total, 1911	160,021	1,210,447	1,370,468	5,823,522
January 1912.....	10,697	95,673	106,370	451,828
February	10,441	92,091	102,532	435,526
March	408	92,597	93,005	395,058
April	10,698	99,708	110,406	468,972
May	9,288	98,104	107,392	456,170
June	1,214	106,930	108,144	459,605
July.....	8,802	96,838	105,640	448,728

OTHER AUSTRALASIAN GOLD PRODUCTION.

	1910	1911	July 1912	1912
	£	£	£	£
Queensland.....	1,840,337	1,623,390	118,130*	734,050*
New South Wales.....	803,727	769,353	70,128	402,760
New Zealand.....	1,896,322	1,808,049	149,160	933,403
Victoria.....	2,422,700	2,138,000	143,900	1,112,300

* June figures only.

SALE OF TIN CONCENTRATE AT REDRUTH TICKETS.

	Tons	Value	Average
Year 1911	6154	£702,599	£114 4 5
Jan. to June 1912	3230	£393,326	£121 14 0
July	244	£294,616	£127 3 11
July 22	2721	£33,749	£123 19 4
August 6	2991	£30,649	£128 2 2

EXPORTS OF TIN AND COBALT FROM STRAITS AND BOLIVIA.
Reported by A. Strauss & Co.

	1911 tons	July 1912 tons	1912 tons
Metal from Straits to Europe and America	55,135	4,610	33,322
Metallic Content from Bolivia to Europe	21,577	1,727	11,920

REVIEW OF MINING

INTRODUCTORY.—A holiday lassitude possesses the share market. After Henley and Ascot come Goodwood and Cowes. The seaside and the moors decimate the attendance of those that direct important business affairs in the City. It is a slack season. We seem to have had much of it lately. However, some signs of life are evident. Just before the bank holiday the Kaffir market had a spasm of activity. It remains to be proved whether it be a flash in the pan or the beginning of renewed public interest in South African mining. West African shares are in the dumps, owing to repeated disappointments and the lack of co-operation between the colonial officials and the mine operators. The Nigerian tin department is feeling the effect of recent disclosures, and is in momentary fear of more. Reports are withheld by supposedly reputable companies, and public distrust is justified. In Australasia the labour troubles have paralysed several mines in New Zealand, but Broken Hill is going strong, rejoicing in the high price of lead. Mexican mining operations are crippled by the unending revolution, but reasonable hope exists that law and order will be restored soon. The Russian group is doing well, despite one or two lame ducks. Interest in Canadian mining is restricted, but the two British enterprises at Cobalt are doing well, and mineral exploration is being undertaken in the big hinterland of Ontario. The movements of mining engineers suggest a likely diversion of capital to Peru, and other parts of South America. The metal markets are strong and money is plentiful. What is needed most of all is the discovery of a new mining district, to give the lead to renewed speculation.

TRANSVAAL.—The June statistics of gold production were satisfactory, remembering that it was a short month and had five Sun-

days. For the first half of the current year the total output was 4,542,907 ounces, worth £19,297,044. This includes an extinguished reserve of 70,143 oz., worth £297,946. Thus the actual yield for the six months was just £19,000,000. For July the output is given as 766,338 oz., worth £3,255,198, showing an increase of £52,681 as compared with June.

Labour statistics are as we had forecasted. In June the number of natives employed on gold mines was 188,494, a decrease of 5335 as compared with May and an increase of 1554 only as compared with June 1911. For July a further decrease of 5569 is recorded, bringing the total to 182,925, as against 181,582 in July last year.

The decrease in native labour was largely neutralized by the more cheerful announcement that independent recruiting was to cease, the principal groups having agreed to co-operate. Mr. Schumacher has testified that the total cost to the mines for native labour in 1911 was £1,200,000 higher than it would have been if the rate prevailing in the early part of 1909 had been maintained, and of the total amount, £1,000,000 "might be attributed to avoidable competition." The cost of independent recruiting of labour, to the extent of 80,000 natives, out of a total of 205,000, has risen 15s. 6d. per month or £9. 6s. per annum since 1906. Of this total increase, 4s. 2d. per month or £2. 10s. per annum is due to an advance in wages. In the last annual report of A. Goerz & Co. it is stated by the consulting engineer to that company that the average cost per native for recruiting, feeding, and housing has risen from £27. 10s. 6d. in 1909 to £34. 17s. 1d. in 1911. Thus, with an allowance of 10% for sick and idle natives, the increased cost in two years represents the lordly sum of £1,195,039 for the mines of the Rand.

Mr. Max G. Elkan succeeds the late J. G. Hamilton as president of the Chamber of Mines. The new president is associated with A. Goerz & Co.

Efforts to supersede hand-drilling by machine work are constantly being made on the Rand. We note that at the Robinson Deep the proportion of hammer-boys to machines is increasing, and that the amount of ground broken per shift proves the greater efficiency of the latter. In 1911 the ratio, in fathoms per shift, was 7'24: 1 in favour of the small machine as against the hammer-boy, and in 1912 the ratio rose to 9'7: 1. Our Johannesburg correspondent deals with this subject in his letter, which is of unusual interest.

The No. 1 shaft of the Modderfontein Deep has penetrated the Main Reef series at 2990 feet, disclosing a total width of 10 feet of lode averaging 8'8 dwt. per ton. After sorting, this should represent 8 feet of 11 dwt. ore. The result is considered highly satisfactory and confirms the deductions made from developments in the adjoining Modderfontein B and Brakpan mines.

The growth of the gold output in the Transvaal is shown by the following figures:

	Month of June	First six months
1908	£2,442,329 ...	£14,442,029
1909	2,621,618 ...	15,447,547
1910	2,655,602 ...	15,557,538
1911	2,907,854 ...	16,889,615
1912	3,202,517 ...	19,297,044

The output for the current year is likely to reach £40,000,000. Hence it is assumed that the mining industry is in a most flourishing condition. This is true if the production of gold be the sole aim of mining in the Transvaal, but it is not; the purpose of mining is to make money in the form of dividends. Production will continue to expand after real profits begin to decline, simply because the treatment of an increased tonnage and the winning of a larger aggregate yield of gold does not necessarily ensure a bigger return on capital. In some cases

it does; in others it does not. The Rand produces more than one-third of the world's output of gold, and it is making lots of money for those who went in on the ground-floor, but it has ceased to afford scope for new enterprise.

RHODESIA.—The gold output in June was 53,875 ounces, worth £226,867, as against £234,407 in May, and £215,347 in June 1911. The number of contributory mines is 168, or one more than in May. The Globe & Phoenix, the Lonely Reef, and the Farvic show notable decreases, while the Bucks Reef, Eldorado, Penhalonga, and Wanderer show small gains.

Mr. C. B. Kingston's resignation as consulting engineer to the Rhodesia Gold Mining & Investment Co., which controls the important Lonely Reef mine, was not prompted by disapproval of the board's policy, nor did we suggest anything of the kind, but we mention the fact as an item of news. The cost of mining at the Lonely Reef has been high on account of the running of the old mill pending the erection of a new one, the dismantling and subsequent reconstruction of the old plant, the lack of labour, especially of the more intelligent type needed to operate the filter-presses, the dislocation of the transport service by an outbreak of fever, and the discovery that the ore had to be ground finer than was indicated by preliminary tests. Also the construction account was closed recently, throwing an extra burden on the revenue account and increasing the 'working cost.' Mr. Kingston now gives the total working cost, including London charges and royalty, as 33s. 3d. per ton, but when the third tube-mill is at work and conditions are normal he estimates that this figure will come down to 30s. per ton. We doubt whether this will be the entire cost to be deducted from the yield before arriving at the net resultant profit available for dividends. Some of the contingencies enumerated above may have been unexpected, but something unexpected happens every year in Rhodesia, as elsewhere, and the calculation of final cost, to

be accurate, must not assume persistence of ideal conditions. To us, as detached onlookers, the scarcity of labour, especially skilled labour, the probability of outbreaks of sickness to men and to transport animals, changes in the arrangement of the plant, and the necessity for purchasing new equipment are all a necessary part of mining in Rhodesia. Again we say that we doubt whether the total cost of mining at the Lonely Reef will be brought below 35s. per ton.

The Wanderer is a Rhodesian mine exploiting a large and soft low-grade gold-bearing lode at a low cost per ton of ore. In the year just ended the ore averaged 2'61 dwt. per ton, of which 1'988 dwt. was extracted in the mill. The operating cost at the mine was 7s. 6d. per ton. On further analysis it is apparent that the metallurgical extraction was only 76%. As the gold obtained per ton was worth 8s. 5d., a profit of 11 pence per ton might be assumed. However, the expenses in London amounted to £2092. 19s. 8d., so that the final profit was £7092, equal to 8½d. per ton. A serious blemish in the detailed report on the development work is the frequent omission to state the width of the ore. Thus a rise "was put up 41 feet, of which 10 feet averaged 7'37 dwt." per ton. This conveys nothing as the stopping-width is not given.

Fragmentary items issued concerning development work in the Shamva mine could be made intelligible by the publication of plans and sections of the workings, with an outline of the supposed shape of the orebody as disclosed to date. The progress of the work may not be easy to describe, but any engineer sincerely desirous of conveying information to the shareholders could succeed in doing so. At present the periodic statements of assay-values and lengths of cross-cuts are only bewildering even to a technical person. Without some notion of the real character of the ore deposit these items are of little value. If the engineer in charge has got a definite idea of what he is do-

ing, he ought to be able to convey it to the shareholders and to the public, which is invited to participate in the enterprise. For instance, on July 18 the shareholders are told that the "Gully adit cut orebody after driving 570 ft.; 5 ft. exposed to date assays 7.8 dwt." On July 23 another cablegram is published stating "Gully adit advanced a further 5 ft., making 10 ft. in all; average assay-value over the 10 ft. is 4.4 dwt., continuing." This is misleading, for if the first 5 ft. averaged 7.8 and the addition of 5 ft. more, making 10 ft., reduces the average to 4.4 dwt., then the second 5 ft. assays only 1 dwt. per ton. Therefore the second 5 ft. was advanced not in ore, but in waste. This is only one more example of the art of giving information that is not informing.

In regard to the Tanganyika Concessions, it is reported that the Belgian Government intends to exercise its right to subscribe, through the special committee of the Katanga, for 5700 shares of the new issue by the Union Minière. This decision, it is added, is dictated by the desire to maintain the Belgian majority, threatened by an important group of British capitalists, anxious to obtain a predominant control. Meanwhile a fresh spurt has been given to the work at the Star of the Congo mine. The damage done by the explosion is being repaired, and the smelter is being furnished with a new steel dust-chamber. European coke is being accumulated as against the time, about a year hence, when coke from Wankie will be available. The blast-furnace is to start again in September.

WEST AFRICA.—The June output of 27,784 ounces of gold, worth £114,697, brings the half-year's production to 161,924 oz. valued at £666,079, as against 111,688 oz. valued at £456,324 in the first half of 1911. This is an encouraging increase. In June the Ashanti Goldfields maintained its normal output of £40,000 monthly, but the Prestea showed a slight decrease, the yield being £22,191.

The Jos Tin Area and the Kano (Nigeria)

Tin Areas will be the first of the Nigerian companies to attempt dredging on an adequate scale. The dredges are to have open-connected buckets of 4 cu. ft. capacity. Oil-engines of the Diesel type will be provided. They will be built by Werf Conrad under the direction of Lake & Currie.

The latest cables from the Ashanti Gold-fields show that the Obuasi shoot has been struck in the cross-cut at No. 9 level. The lode at this point is 19 ft. wide, and the average assay is 36 dwt. per ton. This continuation of the orebody in depth must be highly gratifying to shareholders.

AUSTRALASIA.—At Waihi the strike still paralyses mining operations. In announcing a quarterly dividend of 2s. per share, the directors of the Waihi mine point out that no further distribution can be made until the strike is ended, and that the results of it will adversely affect future dividends. No strike in recent years has been so stupid, from the workmen's point of view, for it is due to a quarrel among themselves, and when settled will necessitate a further loss of wages on the part of most of them while the mine is being unwatered. It is interesting to note that the referendum of British shareholders on the question of acquiring new property, in New Zealand or elsewhere, shows that 999 shareholders favour the proposal and 348 oppose. The matter is now to be referred to the New Zealand shareholders.

Negotiations for the amalgamation of the British Broken Hill Proprietary, Broken Hill North, and Amalgamated Zinc companies broke down owing to the inability to arrive at a proportional valuation of two mines in such different stages of development. The British Broken Hill will proceed with its own scheme of development and equipment, having decided to increase the capital by 75,000 shares, of which 60,000 are to be issued forthwith.

At the North Broken Hill, the main ore-body has been cut by a diamond-drill at the

1250-ft. level. The core shows a thickness of 100 feet, assaying 12 oz. silver, 18% lead, and 14% zinc; thus comparing favourably with the average assay of the ore on the 1100-ft. level, where it averages 7 oz. silver, 15·6% lead, and 14% zinc for a width of 60 feet.

In several recent issues we have referred to the intentions of the Broken Hill Proprietary with regard to the establishment of an iron and steel industry. This scheme is now complete, and the meetings of shareholders have been called to confirm the proposals of the directors. Briefly, smelters and steel furnaces are to be erected at Newcastle, New South Wales, in the coal district, and the iron ore is to be carried thither for treatment from Iron Knob near Port Pirie in South Australia. The additional capital required is estimated at £1,000,000, and it is to be raised by the issue of debentures, which will be subsequently convertible into ordinary shares. The advice of Mr. David Baker, of Philadelphia, was secured before the details of the venture were settled. The Broken Hill Proprietary has paid over £10,000,000 in dividends from its lead and silver business, and considering the vast resources of high-class iron ore at Iron Knob and the large Australian demand for iron and steel, an even greater prosperity may be predicted for the future. Our Melbourne correspondent discusses the subject.

The Great Fitzroy has taken an option on the Laloki copper mine in New Guinea. A favourable report was made by Mr. George C. Klug.

The Transvaal mine has been acquired by the Mountain Queen company from the Lake View and Oroya Exploration Co. on the basis of £4000 in cash and £45,000 in 10s. shares. The Transvaal is a promising little mine. Our Kalgoorlie correspondent is also of this opinion, as appears from his letter.

We note that Mr. D. F. McAulay, the manager of the Associated, gave his estimate of the ore in that mine as between 21s. and 29s. per

ton. To this some exception has been taken, because the limits transgress the margin of profit and loss. However, we commend Mr. McAulay for being as precise as the evidence permitted. A pretence of accuracy is no good to anybody.

A rush of prospectors to Kurnalpi has led to a great amount of speculative pegging of claims. This is a district prominent 15 years ago. It is 50 miles east from Kalgoorlie.

CANADA.—We publish an interesting letter from our Vancouver correspondent, and we give the statistics of British Columbia's mineral production in 1911 as compiled by Mr. E. Jacobs, a name identified with the mining industry of the most western Province of Canada. It appears that the outlook in British Columbia is most cheerful and that the mineral production for the current year will attain a total value of \$31,500,000 as against \$23,499,000 in 1911 and \$26,377,000 in 1910. That at least is the view taken by Mr. Jacobs and confirmed by Mr. W. Fleet Robertson, the Provincial Mineralogist. Apart from the mere bulk of output it is pleasing to note that several new names promise to appear on the list of dividend-paying metal mines. Of late years the Le Roi No 2 and the Hedley have been the lonesome distributors of dividends; this year there will be added the Standard and the Motherlode, besides one or two others not so sure. The Slocan district is undergoing a notable revival, as the result of successful deeper development. The Britannia, on the coast, is coming to fruition; the Granby has opened up a subsidiary copper mine also on the coast above Vancouver; in the Similkameen the B. C. Copper Co. is busily prospecting with drills; even the old district of Ainsworth has become lively; and in other directions there is ample evidence of progress.

In the Porcupine district, the four mills now in operation are estimated to be producing about \$40,000 worth of gold per week. The contributory mines are the Dome, Hollinger,

Vipond, and McIntyre. Other small mills are being erected. The East Dome has been closed down. The Jupiter promises to do well. Several 'wild cats' are at the end of their resources. The boom is over and sober views prevail.

At Cobalt the shipments of bullion continue to increase. The Nipissing's low-grade mill is to be ready in November. This famous mine continues to be highly productive. New veins have been found at the surface by hydraulic mining the overburden. The total of dividends paid by Cobalt mining companies is \$3,578,399 for the first half of the current year.

UNITED STATES.—Our San Francisco correspondent sends an interesting budget, dealing largely with Nevada and Alaska. The big mines at Treadwell continue to be typical of the successful exploitation of low-grade gold ore under capable management. Dredges near Nome and in the Iditarod district seem to be making progress. When our correspondent wrote, the nomination of Mr. Roosevelt had not been made, but he makes intelligent anticipation of that event and its effects. Apparently the trend of political events has not intimidated Wall Street, and we expect a notable return of American industrial confidence as soon as the Presidential election is over. The copper mines are profiting enormously from the rise in the price of the metal. At 17 cents the resultant profit to low-grade mines is nearly twice what it was at 15 cents, so that many companies have earned as much in the first half of this year as in the whole of last year.

MEXICO.—Administrative affairs continue to be confused. Several mining companies have been compelled to suspend operations, while others announce an abatement of disorder in their own vicinity. Thus the shareholders of the Buena Tierra, in the Santa Eulalia district of Chihuahua, have had to forego a dividend because the destruction of railway bridges has prevented the arrival of dynamite and other supplies. Similarly the Chihuahua smelter, to which this company's

ore is delivered, has been unable to obtain either the coke or the labour needed to maintain its operations. However, the consulting engineer, Mr. R. M. Raymond, writes cheerfully. The rebels have been driven away, with no time for further looting, and the railway is open to Chihuahua. But the line northward to El Paso is still interrupted, and discontent among the miners still hampers the managers. Meanwhile the Buena Tierra mine is opening up well, the eastern orebody proving to be larger than was anticipated, and if the restoration of order is completed the returns should improve steadily. From the Avino mines comes the news that the revolutionists have abandoned that part of Durango and have made tracks for Sonora; hence it is hoped to resume the shipment of ore. Again, to show the vicissitudes of mining in a country of inchoate political ideals, the Tominil company has appealed through the British representative to the Mexican government, asking for protection. The Tominil mines are in the Tamazula district of Durango. Owing to repeated dynamite outrages, it has been impracticable to continue operations; therefore the manager and his staff have gone to Mazatlan, and the Government has been notified that it will be held responsible for the protection of the property.

A three-days battle near Cuernavaca, 45 miles from the capital, is said to have ended in a rout of the Zapata bandits. This occurred after a train had been wrecked and 20 passengers burnt to death in the wreckage. The reported attack by Mexican insurgents upon an American patrol along the Sonora border is serious, as it may lead to complications. Similarly, the rumour that the United States government has asked for the cession of the peninsula of Lower California, as recompense for damages to American citizens, is fraught with international trouble. Lower California is valuable to the United States as a naval base. Among the mines on this peninsula are the Boleo cop-

per property, owned at Paris, and the old Progreso mine at Triunfo, owned at San Francisco.

INDIA.—Reports from the Champion Reef continue to provide interesting reading, for the developments at the Garland, Glen, and Carmichael sections are all satisfactory. In a winze below the 36th level south of Garland's shaft, the ore is 2 ft. wide and averages 29 dwt. per ton. The 39th level south of Glen's shaft is in ore 2 ft. wide assaying 25 dwt. per ton, and in the lowest working in Carmichael's section, a winze below the 42nd level, the lode is 2½ ft. wide averaging 25 dwt. per ton. Better news is to hand from the Balaghat mine, which has been in a bad way the last year or two. The recent developments on the 1250-ft. level have disclosed at two places ore containing over 1 oz. per ton, and averaging nearly 5 ft. thick. The managers are anxiously awaiting news as to the results of further work.

RUSSIA.—The meetings of the Siberian Proprietary and its two subsidiaries, the Troitzk and Orsk Goldfields, have drawn attention to two enterprises on which much earnest effort has been spent in the hope of retrieving early failures. The Troitzk mine has been unwatered after the fire and development work resumed, with some success; for the resident engineer announces an improvement in the lode at the 680-ft. level. The Orsk is winning gold from its dredge on the Kolchan placer and its stackersco on the Pokrovsky placer. The scow is to be converted into a 3½ cu. ft. bucket dredge, on the advice of Mr. C. H. Munro.

VARIOUS.—The South American Copper Syndicate, which has been able to pay 250% in dividends during the year, is a successor to the Quebrada Railway, Land, & Copper Company, which operated the same mines from 1881 to 1894. In 1907 the present company re-opened the mines, which are known as the Aroa or Quebrada mines, 67 miles west of Puerto Caballo, in Venezuela. We note with satisfaction that Mr. W. A. Heywood has been retained as metallurgical advisor.

EDITORIAL

WE PUBLISH letters from Lima, Auckland, Kalgoorlie, and Vancouver, in addition to the usual special correspondence from Johannesburg, Melbourne, New York, San Francisco, and Camborne.

UNDER 'Discussion' we publish interesting letters on 'Phantom Profits' by Messrs. W. H. Trewartha-James, W. R. Feldtmann, W. H. Goodchild, and Edward Walker. In our next issue the discussion will be resumed by Messrs. S. J. Speak, Ernst Lichtenberg, and H. S. Denny. These contributions throw further light on a subject of basic importance.

AN AUSTRALIAN member of the American Institute of Mining Engineers and a Mexican member of the Institution of Mining and Metallurgy recently united in complaining to us that on calling at the headquarters of their respective societies they were received with formal courtesy but were not invited to use the reading and writing rooms, nor were they even informed that such facilities were at their service.

SUMMER HOLIDAYS are taken conventionally by most of us, until it becomes almost bad form to be seen at one's office during an Ascot or Henley week. For instance, the Institution of Mining and Metallurgy holds no session from May to October, presumably on the supposition that its members take a vacation as long as that of an undergraduate. It is a matter of fact, however, that more engineers are in London in June and July than in any other months. Many of those home on furlough express regret at the loss of the opportunity to attend a meeting of the Institution. On the other hand, a meet-

ing is held at Christmas; this is poorly attended and perfunctory. Why not abolish the December meeting and replace it with one in June, when the British metropolis attracts engineers from every quarter of the world?

MR. HENNEN JENNINGS' presence in London was signalized by a dinner at which he met many of his old friends. Undoubtedly he was connected with the Rand mining industry at a time of wonderful expansion and he proved himself invaluable as a wise and sagacious advisor to the biggest of the groups of financiers that then made a golden harvest. He found time to take a keen and effective interest in educational matters, more especially the re-organization of the Royal School of Mines. Of the many American engineers who have won fame and fortune by participation in British enterprise he was one of those most respected and liked by his English confrères. He gave dignity to the profession. We might say more, but this paragraph is not an obituary. Mr. Jennings, we are glad to see, is in excellent health and is far from the time when a final appreciation is either needed or desired.

IN a recent issue of *The Financial News* a note appears referring to Butte, and changes in depth as regards the most valuable metal in the ore. It is then said: "Geological surveys sometimes fail in their object, and the question why is beginning to agitate the minds of some American experts." This is only quoted in order to be refuted. It conveys a misapprehension. The excellent work done by the U. S. Geological Survey at Butte, Leadville, Grass Valley, Bisbee, and other important mining districts is matter of common knowledge. No men set a higher value on the reports of the

Survey than the members of the mining profession, not in America alone, but the world over. These reports have proved not only scientific monographs but a first aid to the actual search for ore underground.

THE CELEBRATION of the 250th anniversary of the founding of the Royal Society has been marked by national and international functions of an appropriate character. Among the very few wise things done by Charles II may be counted his patronage of the Royal Society when in its infancy. He appears to have had an admirably sane idea that it was expedient to consult students of natural science as well as politicians, more particularly on matters affecting British industries. This honourable tradition survives, for the Government of today frequently asks for the advice of scientific specialists; but hardly enough. The organization of intellect, as suggested by *The Times*, can be carried yet further, to such a degree that our British method of 'muddling through' will be replaced by scientific attack on the great problems of national development.

IN a mining circular issued by a brokerage firm and simulating a financial journal, we find the following comment:

"The Mining Magazine editorial and advertising departments apparently never have a conference, or we should not see a slate of the Sissert Company—a justifiable slate—in the editorial columns and a puff costing £7. 7s., I believe, in the advertisement columns,"

and so forth. The foregoing remarks are intended to be sarcastic, but they simply state a fact with exemplary exactitude. It only remains to add that the "puff" was not composed in this office, but came to us unsolicited through a regular advertising agency. Our advertising pages are for sale to those who want publicity at fixed charges; our reading pages

are not for sale at any price. The fact that this Magazine reaches the responsible men engaged in mining operations the world over is the reason why it is a successful medium of publicity, and because it fulfils this function profitably its editor is able to express unprejudiced opinions. It is the one and only way in which journalism can be made both self-supporting and self-respecting.

IN the latest bulletin issued by the American Institute of Mining Engineers we note, as usual, several interesting reviews of books by the secretary emeritus, Dr. R. W. Raymond. The veteran editor remarks in one instance that the author has omitted bibliographical references and acknowledgment of the writings of precedent observers. He also commends another author for giving an excellent classified bibliography, which enables the reader to refer to various treatises and papers covering the special points under discussion. We desire to support Dr. Raymond in thus drawing attention to the need for proper references, either in the shape of foot-notes or of a more formal bibliography. It is neither generous nor scholarly for a man to write on a given subject, appropriating the ideas of others or referring to parts of a subject previously elucidated by another man, without making suitable acknowledgment. Those who sin in this regard are mostly novices and it may be that they err ignorantly. These remarks may serve as a reminder.

A PUBLIC INQUIRY held recently before the London Bankruptcy Court will have suggested, to those who read the record appearing in the daily press, what queer things are done by directors who act nominally as trustees for shareholders. The affairs of the Rhodesia Goldfields, Limited, were being wound-up after a chequered career of tortuous finance. It was disclosed that two of the directors were equally in-

terested in the promotion of the company, and made a handsome profit out of the £5000 set aside for the expenses of registration, advertising, &c.; one of them as managing director had complete control of the administration, yet sales and purchases of shares were made through the firm consisting of these two directors; and they sold shares on company account and on their own, making 6s. per share more profit for themselves than for the company. It remains disputed whether the £4809 of commission received direct from the brokers was made known to their co-directors, for they were "entitled," so they said, to one-half commission on all the business they did with the brokers. Other involutions of business were outlined, but, not being familiar with the intricacies of this 'branch' of mining, we shall say no more. Suffice it to state that this is the sort of thing that has disgraced Rhodesian mining and gives the public ample reason for choosing other avenues of speculation.

ON July 11 the following cablegram from the Kalgurli mine, at Kalgoorlie, Western Australia, was quoted in the financial press: "Willy-willy today demolished both smoke-stacks main shaft boilers everything will be closed down only for a few days." Not many will have understood the meaning of this strange message. Whatever it was, the agency that demolished "smoke-stacks, main shaft, boilers, everything" must have been powerful and reckless. Punctuation may prove that the main shaft itself was not injured, but only the smoke-stacks near the shaft; and it may be that "everything will be closed down" rather than wiped off the face of creation. This must have been a phenomenon. When anything is beyond our comprehension, we call it a 'phenomenon.' However, in this case, having seen many a willy-willy on the rampage we know that it was not a 'weary Willie' or tramp, it was not a water-

spout or a cloud-burst, it was not a thunder-bolt or a visitor from outer space; it was a cyclonic dust-storm. 'Willy-willy' is the native name for gyrating columns of dust that swirl across the arid surface of the interior plateau of Western Australia. They are unpleasant when encountered in the open country, and they are hideously disagreeable when they valse down the wide streets of corrugated-iron that mark the avenues of a mining settlement. In careering across the wide spaces these cyclonic columns gather everything loose in their path, from bits of paper to tin cans, and throw them broadcast. When large and vigorous they unroof houses and smash telephone poles. The one that demolished the Kalgurli smoke-stacks and boiler-house must have been of exceptional violence. However, a bear might have done even more damage to Kalgurli shares.

Directors' Fees.

Lord Harris, at the Gold Coast Amalgamated meeting, and the Hon. John de Grey, when presiding over the Bulawayo Exploration meeting, took pains to state frankly that their work as directors was not done for their 'health,' but as a means of gaining an honourable livelihood. We are glad to have these plain pronouncements, for we regard the work of a director, if conscientiously performed, as highly useful and well worthy of proper remuneration. What has hurt the status of a director, especially in mining companies, is the fact that many men of prominence in other walks of life have accepted an honorarium for the use of their names without asking themselves how they were fitted to take part in the administration of technical affairs for which they had previously had no training. They may have been too self-complacent to divine that they were to be used as lures to the unwary speculator or as giving a *cachet* to financial performances of a vulgar sort. Some of them do finally obtain a modicum of ex-

perience in mining at the expense of the shareholders, and others, in consequence of a fortunate connection with successful mines, win a reputation that makes them desirable additions to the boards of new enterprises. On the whole, however, the director, as such, is not taken, among mining engineers and others professionally engaged in mining, with nearly as much seriousness as he takes himself, except on those eventful occasions when appointments and retainers are offered, accorded, or cancelled by the authority vested in him as an officer of the company. We do not view the ambiguous and nondescript status of a director with any satisfaction, for it is obvious to us that the welfare of mining depends upon skillful and trustworthy administration, beginning in the board-room in London. Therefore, anything that raises the position of the director as an official, must tend to the betterment of mine management. No real improvement can ensue until the director is recognized not as one who lends his name or sells it, to adorn a prospect or to entice the public to subscribe money for risky ventures, but a professional man, paid for services that are worth the payment they receive. A man who has had business or executive experience, who has an intelligent interest in mining, and who has retired from his previous occupation, may be well adapted to discharging efficiently the duties of a trustee for the shareholders in a mining company, provided he gives his energies and time to such work. For him who accepts a directorship as a *pis aller* we have no use, nor for him who sells an honourable name to eke out a precarious living, nor for that unnatural pervert the guinea-pig who acts as a stool-pigeon for predatory promoters. These must be eliminated, and the sooner the better. When they are gone, there will be a better chance to retain Lord Harris, the Hon. John de Grey, and other men who take the responsibilities of a mining director with seriousness and regard the work as truly professional. To us

the director is no less a professional man than the engineer, and it is time that he should be so regarded.

Gold Mining in West Africa.

We question whether the confession of dis-appointment made by Lord Harris at the meeting of the Gold Coast Amalgamated or the boosting letter of Mr John Moffat appearing in *The Financial Times* is the more depressing to those who had hoped that gold mining in West Africa would become a profitable industry. Lord Harris represents large financial interests that found money for the development of several of the most important mines on the Gold Coast, chiefly those exploiting 'banket' or gold-bearing conglomerate. The previous experience of his company, the Consolidated Gold Fields of South Africa, had been so fortunate with this type of ore deposit, on the Rand, that, as he himself says, it was only natural that the bulk of their investments in West Africa were in 'banket' mines. But the experience in one part of the African continent was not repeated in the other. We are reminded of a story sent to us from the Malay States. When Mr. J. B. Scrivenor, the present Government Geologist, arrived from England, to undertake the work that he has done so well, a prominent official was heard to exclaim at the club: "That young Scrivenor thinks geology in this country is the same as in any other country. He will damn well find he is mistaken." Fortunately for Mr. Scrivenor and the Federated Malay States, the principles of geology are as applicable in the Orient as in the Occident, but the distribution of gold, unfortunately for Lord Harris and the Consolidated Gold Fields, is regulated by factors that are intensely local. For the noble chairman had to confess that "the character of the formation is not so regular as it was on the Rand." In plain English, the ore is patchy. Also "the shutes [meaning 'ore-shoots'] are not so long, and there is naturally a somewhat similar tend-

ency in both places for the grade to fall in value as you get down in depth." It would be well for Lord Harris to inform Sir George Farrar and Sir Lionel Phillips of this important conclusion, which is, of course, also a fact; for these two gentlemen asserted boldly in March 1910 that there was "no evidence whatever" of impoverishment on the Rand once the mines were below the zone of oxidation, and they said this despite the most explicit testimony to the contrary from Mr. Frederick Hellmann, then manager of the East Rand Proprietary, as related in this magazine in November last. Lord Harris, it is true, said that his confession was a "general observation" and added that at "the Abbontiakoon, in which we have a very large holding indeed, the formation is looking quite encouraging." We fear that the "very large holding" is not without its influence in making the Abbontiakoon formation appear "quite encouraging." Passing from geological formation and gold distribution, Lord Harris spoke sadly concerning the many obstacles to successful mining on the Gold Coast, as regards "labour, climate, food, and local administration." Here we are in complete accord. The Government has shown scant sympathy with the earnest effort to develop the mineral resources of the Colony. The railway rates are high, the control of labour is inadequate, and the facilities for importing food are insufficient. "Although the British Government encourages the exportation of labour from the East to British colonies on the western side of the Atlantic, for some reason or other they will not permit the exportation of labour from India, for instance, to the West Coast of Africa; that is, to these colonies on the east side of the Atlantic." Here indeed we have an anomaly, against which Lord Harris rightfully protested. Labour is essential to industry and we have no sympathy with sentimental reasons that restrict free-trade in the most valuable of all commodities.

The long letter by Mr. John Moffat is not

in the least convincing. He says that "Lord Harris implied that the mines are falling in value at depth, but I am assured by the highest authority that this is not the case." Is Mr. Edmund Davis that highest authority? Mr. Moffat dared to say that "the Prestea has developed into probably the world's finest quartz mine." This is bunkum, unless we are to take 'quartz' literally as the mineral to be exploited. "Costs there will eventually fall to under a sovereign; and profits, even without any additions to the mill, should equal over £280,000 per annum." The total cost now is over 33s. per ton and we have no reason to believe that, if the account is properly kept, the total cost will ever be reduced to anything like 20s. per ton. The profit of £280,000 per annum is an iridescent dream, made of such stuff as pleases optimistic scribblers to the daily press. Mr Moffat says that the Gold Coast Amalgamated and sundry other shares "are all under-valued." In December, according to this prophet, we shall have a series of record gold outputs, followed by a Christmas or spring boom. That is the nigger in the woodpile. "A rise can be easily engineered," says Mr Moffat. And we say to him that mining does not subsist on schemes for booms that permit insiders to unload when they have ascertained that they have blundered. West Africa has been cursed by premature booms. What is needed is the facing of unpleasant facts, cordial co-operation between the Government and the mining operators, and a patient effort to attain such measure of success as is practicable after disillusionment.

M.I.M.M. or M.I.C.E. ?

If anything were needed to confirm the idea that mining engineers belong to a nondescript social stratification, it would be the habit of several prominent members of the profession to adorn themselves with the luminous tail of M.I.C.E. Membership in the Institution of Civil Engineers affords no guarantee, scarcely

a suggestion, of experience in mining. Fellowship in the Royal College of Surgeons might conceivably be more to the point, seeing that it involves the ability to diagnose the sinking feeling of a chairman about to address his recalcitrant shareholders or the capacity to cure the hysteria of those same shareholders after the chairman had given his 'explanation.' Joking apart, the civil engineer, as such, is no more competent to be an advisor on the operations of a mine than an electrical engineer, as such. Of course, an electrical or a civil engineer may know all about mining, but that must be regarded as a felicitous coincidence and not a logical consequence. The use of M.I.C.E. as an honourable suffix or pyrotechnic appendage by members of the Institution of Mining and Metallurgy goes far to belie the claims of that organization to select membership of those most competent to be mining practitioners. We believe that those claims are being made good, and we suggest therefore that, in loyalty to their organization, those members who also have the right to use M.I.C.E. should give preference to M.I.M.M. When a mining engineer writes M.I.C.E. after his name we are impelled to exclaim R.A.T.S.

Tropical Diseases.

We publish an article by Mr. T. Lane Carter, formerly well known on the Rand, dealing with the dangers to be faced by an engineer living in a tropical climate. The author of the article writes not as a physician but as a mining practitioner who has gone through enough personal experience in such matters to warrant him in tendering advice to others about to face similar dangers. It so happens that the past month has seen the laying of the first stone of the new buildings of the London School of Tropical Medicine and a public effort to raise funds for the extension and development of that School. The name of the enterprise is almost enough to suggest its worthiness; surely it is fitting that

the seat of world-wide empire should include some institution designed to afford special facilities for the study of the maladies to which the men of the temperate zone are victims whenever they invade the tropics. The British flag shares dominion with the mosquito in many regions. If Anglo-Celtic energy succumbs pitifully at some times and in some places when attacked by the miasma of the jungle, it is at least out of date to impute the unpleasant fact to a bogey called 'climate.' It is not 'climate' but bacillus. Sir Patrick Manson and Sir Ronald Ross were the benefactors who discovered the part played by the mosquito in serving as a carrier of malignant animal parasites that invade the human body and propagate disease. The recent salubrity of Havana and the record of the Panama Canal zone bear eloquent testimony to the accuracy of the diagnosis. No more remarkable example exists of man's conquest over Nature when in her least amiable mood. To public men, such as Mr. Austen Chamberlain, who presided at the recent meeting, and to Sir Edward Grey, who moved a resolution commending the call for funds, the School of Tropical Medicine should appeal obviously, for they know how many picked specimens of our race are sacrificed to the administration of empire in tropical regions. To the readers of this magazine, having an interest in mines near the equator and in the most pestilential parts of the earth, it is hardly necessary to commend a scientific effort to check the ravages of febrile and other diseases rampant in districts where men dig for tin and gold, as well as other metals. The experience of British operators in West Africa and Central America, for example, has shown conclusively that the economic success of mining enterprise suffers not only from the positive illness of managers and staff, but persistently and continuously from a malaise that saps the energy of every white man. This is not due to heat or to food but to the presence of germs

to which the native is largely immune. Such germs can be combated or killed by medical remedies and counter-irritants, until the time may come when the white man can be as healthy in the tropics as the native himself. When that day comes the usefulness of our race will have been enormously multiplied and our children will have gained a wider heritage.

Eldorado Banket.

Early in 1911, when exposing the feverish effort to boom Rhodesian shares, we referred to the Eldorado Banket as an example of over-valuation. It was then a mine that was yielding most satisfactorily, but the experience of mining in general and of Rhodesia in particular did not justify the assumption that the orebodies would persist indefinitely in depth. Moreover, like most Rhodesian mining companies, the Eldorado gives phantasmal estimates of cost. According to the annual report just issued the ore reserves on March 31, 1912, amounted to 149,749 tons, having an average assay-value of 15'13 dwt. per ton, as compared with 197,343 tons averaging 16'36 dwt. a year previous. The decrease of 47,594 tons is due to the faulted ground penetrated on the 8th level. On the 8th and 9th levels the orebody in the main lode is from 110 to 115 feet long, which is said to show "no reduction in length over the previous level," that is, the 7th; but the report omits to acknowledge that the lower levels exhibit a notable decrease in the length of stoping ground as compared with the 5th level, where the orebody was 530 feet long. Having in mind the Rhodesian habit, avoided by the Eldorado, however, of speaking of the assay-value of an ore as 'value,' without regard to the loss in milling, it is interesting to note that the Eldorado makes a recovery of 93%, namely, 11'6 dwt. out of ore assaying 12'4 dwt. per ton. This looks good enough at first sight, but the ore in the mine was estimated to contain 16'36 dwt. at the

end of the previous financial year; we have no reason to suppose that ore below the average was milled; therefore the 11'6 dwt. extracted represents only 72% of the assumed assay-value. This deduction is confirmed by the admission of Mr. H. A. Piper, recently appointed consulting engineer, who discounts the average assay-value of the existing reserves by 2½ dwt., reducing the 15'13 dwt. to 12'63 dwt., which is close to the assay of the ore as received at the mill. The 'working cost' has been reduced by 1s. 8d., that is, from 23s. 11d. to 22s. 3d. per ton. The consulting engineer fails to make it clear that the cost of development on the 39,721 tons developed is 6s. 3d. per ton, as against the actual charge of only 2s. 10d., which is made on the basis of the 87,315 tons ore milled. Thus the 'working cost' becomes 25s. 8d. But this, of course, is only part of the real cost of operating the mine. Sundry and inevitable expenses in London and South Africa amount to £5,576, and the directors' percentage of profits makes £3000 more, not to mention allowances for depreciation. By the directors, of course, the £3000 is regarded as 'profit'; to the shareholders, it is 'cost.' Thus £8576 must be added to the cost. This is 1s. 9d. more per ton, and when added to the 25s. 8d., it raises the total cost to 27s. 5d. per ton. But in the ore reserves is included the ore of the Parallel Reef, namely, 81,489 tons having an average assay-value of 6'16 dwt. per ton. Allowing a recovery of 72% of this sampling assay-value and a total cost of 27s. 5d., it is obvious that this 6'16 dwt. ore will be treated at a loss of 10s. per ton. Again, the 10,380 tons of "broken ore in dumps and in bins," averaging only 5'5 dwt., is rock that should have remained underground. Similarly the 6171 tons of "broken ore in stopes," averaging 8'57 dwt. per ton, is not profitable. The real reserve is only the 51,709 tons of 31'97 dwt. ore, which on a recovery of 72% and a cost of 27s. 5d. per ton, will yield a profit of

about 70s. per ton or a total profit of about £180,000 on 300,000 shares now quoted at £2. Thus one third of the market price is assured and the shareholders are speculating two thirds of their capital, and all their interest on that capital, in a mine that gives signs of debility in depth.

Since the above was written the annual meeting has been held, but without adding to the information available. It is true Mr. R. G. Fricker, the chairman, acknowledged that "on the 7th, 8th and 9th levels the ore-shoot on the main reef is, we believe, fully exposed, and shows a lateral decrease over the upper levels." What does "lateral" mean? Mr. Fricker is referring presumably to the longitudinal extent of the orebody, not to its width. A worse ambiguity marked the cablegram from Bulawayo. Apparently the chairman did not know what it meant, and telegraphed to the consulting engineer, who also seemed at a loss. The only confident person was Mr. H. G. Latilla; a fact not nearly as helpful as it ought to be. Why cannot the Rhodesian managers send cablegrams that are intelligible beyond a doubt? From this and many other experiences it would appear that every mine manager should pass an examination in the art of sending dispatches that cannot be misunderstood. Meanwhile, the incident may be taken as in keeping with the present-day traditions of Rhodesian mining finance.

Institutes and Institutions.

The report of the committee appointed to investigate the affairs of the American Institute of Mining Engineers has been issued. We commend it to the thoughtful consideration of members in kindred societies. If a crisis has arisen in the affairs of the American Institute, it is due to causes that may come into operation at any time in the life of a similar organization. Whether managed by one man or by many, no professional organization is likely to maintain its prosperity and

efficiency unless the members as a whole take an adequate and continuous interest in its affairs. A dominating personality may prove stimulating, but it is a stimulus that may be obtained at the expense of general participation; on the other hand, the delegation of powers to numerous officers may be carried so far as to become merely a multiplication of honour, with a division of personal responsibility almost to the vanishing point. Like all forms of human government that of a mining institute is inevitably a compromise. A capable Secretary must be influential on account of his continuous tenure of office and the consequent familiarity with precedent procedure, but the recognition of his ability should not end in making the President a super-numerary. By virtue of his being selected as chief and by reason of his devotion to administrative duties during his comparatively brief term of office, the President is entitled to exercise a large share of influence. When he and the Secretary are in accord, the affairs of the Institute or the Institution are apt to be well managed, especially if both of them keep in touch with the general membership as represented by the Council. Despite the inherent weaknesses of any scheme of corporate administration, it is pleasant to record the harmony and energy displayed by most of the societies that minister to the needs of mining and metallurgical practitioners. But the troubles of our friends in America should serve as a warning against a policy of *laissez faire*. Into the causes that brought about a crisis in the American Institute it would be unseemly for us, at this distance, to probe; we regret it deeply, and we hope that the public spirit shown by the members of the investigating committee when joined to the good sense of those who have been called to account, will result, not in a breach of good fellowship, but in a united effort to amend conditions that are the result largely of mere drift. We join with the committee in urging the members of the

American Institute, and other similar societies, "to increased interest and co-operation," and we unite with them in concluding that "the membership should keep itself informed as to the affairs of their society, and by attendance and discussion at meetings and otherwise, inquire and criticize and be assured to their satisfaction that the business, both technical and financial, is conducted by modern methods and in a manner to insure prosperity."

Mining in China.

In our April issue we published a letter by Mr. A. R. Weigall in regard to the mining regulations in China. In that letter attention was directed to the fact that the new regulations prepared by Mr. Wallace Broad, at the instance of the Chinese Government, have been placed on the shelf. After the Boxer rebellion a commercial treaty was signed (in July, 1903) between Great Britain and China, and by Article IX of that treaty it was agreed that the Chinese Government would revise its mining regulations, in conformity with those ruling in other mining regions, and in such a way as to facilitate the application of foreign capital to mining in China. Thereupon the Viceroy Chang Chih Tung prepared a new set of regulations, 38 in number, which were published in 1904, but were so contrary to the terms of the treaty that the foreign ministers protested unanimously and successfully. Then came a further revision and the regulations approved by the Throne in 1907. These also were considered highly inimical to foreign participation in the development of China, whereupon Mr. Broad was engaged to draft a new set of mining laws. He completed his task, and that is the end of it. Nothing has been done. Foreigners are still hindered by impossible restrictions. Now is the time to bring the matter forward. It must be understood that the Western nations are not asking for privileges but for rights definitely granted to them by treaty. These rights remain in abeyance

simply because their diplomatic representatives have made no real effort to establish them. Our own Government acted on behalf of the other Powers and these now look to England to press the matter. Lack of insistence will cause the subject to lapse into obscurity, in accord with traditional Chinese policy. Now, however, a new opportunity has arisen to retrieve the position. China is being renovated; a new government is in control. Cannot our diplomatic representative be galvanized into action on this important matter? Unless proper pressure is exerted the mineral resources of China will remain lost to the Western World of our generation and China herself will lose a stimulus to industrial development that she can ill afford to reject. More than one member of Parliament is identified with the mining business of the City of London; we trust that they will give timely attention to this important question.

Institutes as Publishers.

We note with interest that our esteemed American contemporary *The Engineering and Mining Journal*, in commenting upon the crisis in the affairs of the American Institute of Mining Engineers, states that "the organization possesses a valuable name, history, and prestige, but membership in it has become so promiscuous that no value is attached to that, and about all the benefit to the majority of members has been the receipt of an annual volume of transactions, the need for which is now very much less than it was in the days when the technical press was young and inefficient." With the concluding expression of opinion we associate ourselves confidently. Indeed, the troubles of the American Institute arose largely from the fact that the permanent Secretary was primarily a great editor, so that the efficient publication of technical literature became the supreme function of the Institute. To do this it became necessary to sacrifice homogeneity of membership in the effort to obtain the numbers assuring an income ade-

quate to meet the expense of issuing high-class publications to a limited clientele. As the publication of technical papers became the paramount purpose, the other functions of the Institute, as a professional body, were subordinated. When the Institute came into being in 1871 and during the years of its most vigorous growth under the command of Dr. R. W. Raymond, the journalism of mining was undeveloped. It is true the *Engineering and Mining Journal* for a time, when Dr. Raymond was associated as editor of that journal with Richard P. Rothwell, did print all the papers read before the Institute, but that was not for long. During Rothwell's editorship the *Journal* grew in efficiency and interest, but nothing like so fast as the Institute's publications, in pamphlets and volumes, under the management of Dr. Raymond. But conditions changed. One of the chief factors in making the Institute publications valuable was the aid of the officers of the United States Geological Survey. In the 20 years between 1885 and 1905 the leading geologists of the Survey were frequent and voluminous contributors to the transactions of the Institute. Mining engineers, thanks to the geological researches of Emmons, Hague, and Becker, for example, were becoming keenly alive to the necessity for studying the genesis of ores and the structure of ore deposits. The scientific men on the Survey were glad to win a larger audience among those actually engaged in the exploitation of ore deposits; they were assured of having their papers published with a promptitude relatively greater than that of the office at Washington, and they obtained the sympathetic revision of an incomparable editor. They, and others, regarded the editing of their writings by Dr. Raymond as a decisive reason for sending their papers to the Institute. But this condition did not last. As the literature of economic geology increased it became natural for the geologists of the Survey, professors of geology in the universities, and geological

practitioners to establish a journal or magazine devoted to their own subject. Hence *Economic Geology*, a periodical collection of scientific essays, came into being in 1905. Since then the Institute has been deprived of an increasing proportion of the important papers written by its geological members. At the same time the technical Press, that is, the weekly and monthly papers issued by publishers with a view to winning the support of those commercially and professionally engaged in the business of mining, has grown in usefulness and influence to such an extent as to draw many of the articles and essays formerly sent to the Institute, or to similar publishing media; and with good reason. An article sent to the *Mining and Scientific Press*, the *Engineering and Mining Journal*, or the *Mining Magazine* is published more promptly and reaches more readers than if it appears in the proceedings of a society. Moreover, it receives better revision. When Dr. Raymond was secretary of the Institute and was at the height of his editorial activity, he was incomparably the most efficient reader and mender of technical writings. At that time the technical papers could ill afford to pay for the entire time of a competent editor, nor did the small quantity of matter published by them require the daily occupation of such a specialist. Now the technical papers—the three mentioned as most directly devoted to mining, but others also—have prospered so that they publish a great deal more than formerly and they are now able to pay the salary required by a competent editor. On the other hand, the professional societies cannot afford to engage both a first-class secretary and a first-class editor, while the combination of the two in a single person is too rare to be within the domain of practical politics. Hence they are satisfied with an efficient secretary and leave the editing to a committee of amateurs, to the casual mercy of a proof-reader, or to the authors themselves, most of whom are lacking

in experience as writers, however eminent as engineers. Thus the technical journal has passed the technical society as a medium of publication. And it is well that it should be so. The institutes and institutions have other and better functions to perform: to bring professional men together, to promote the solidarity of the profession, and to crystallize a code of ethics out of the amorphous practice of men who are more devoted to business than to science. Discussions and debates organized by such societies are most profitable as a means of eliciting experience and ideas, but these need not involve the business of a publisher, for which other agencies are better qualified. Efficiency in life is promoted by each man performing the task for which he is fitted; this applies also to human aggregates.

Prestea.

According to the published accounts of the recent annual meeting of the Prestea Block A company, the shareholders treated their chairman and board of directors most considerably. A year ago Mr. Edmund Davis, the chairman, stated categorically that the entire new mill of 110 stamps would be in operation in the following November or December, and that it would treat 30,000 tons per month, at a profit of £20,000 to £25,000 per month. He added: "I trust you will be satisfied with the forecast I have outlined, as I feel confident that it will be realized." We have good reason to believe that the manager at the mine and his chief assistants knew then that no such amount of ore as 30,000 tons monthly could be taken out of the mine, and therefore that the estimates of profit contingent on such a production were fallacious. After Mr. Davis had made his confident forecast, he met the manager and learned his error. As we said at the time, this is an example of administration almost humorous in its stupidity. The sequel is in accord with the episode. Instead of a profit of £20,000 to

£25,000 per month the Prestea earned £2701 for the year, and the shares, which stood at 30s. on June 28, 1911, were quoted at 17s. 6d. on July 18, 1912. The record of this mine is an exhibit of optimistic estimates that were never justified. The estimate of working cost has been repeatedly wrong. In 1909 the chairman quoted the consulting engineer as saying that "the total cost of working the property should not exceed 20s. per ton." A yield of 40s. at a cost of 20s. was cheerfully promised by another consulting engineer to the company. In 1911 the average working cost was 28s. 2'6d. But London expenditure and depreciation are not included, nor are these items mentioned in the chairman's report. We find from the accounts that on 93,483 tons milled in the 8 months of 1911 these expenses amount to 5s. 6d. per ton. Thus the real cost is 33s. 8'6d. per ton for the period mentioned. The yield was 34s. 3'6d. per ton; therefore the net resultant profit was only 7d. per ton of ore milled. It is true the output has been restricted by defective arrangements for re-filling the stopes, so that only 60 stamps have been supplied with ore, but the preservation of the safety of a mine by re-filling old stopes is a fundamental part of the necessary operations. At the Prestea the soft character of one of the wall-rocks has been known from the beginning and special care to overcome this difficulty should have been taken. Quite apart from this, the mill capacity, of 30,000 tons monthly, was far in excess both of the hoisting equipment and the tramway. On the whole, the plant has been, and is still, badly proportioned; just as the mine itself has been out of focus to the roseate speeches of the chairman. The Prestea is an example of mining subordinated to share-dealing; a great deal of cleverness has been expended on the operations in London while those at the mine have been bungled. The primary purpose of mining is to dig ore at a profit, not to sell scrap at an advance.

METAL MARKETS

COPPER.

Average prices of cash standard copper :

July 1912	June 1912	July 1911
£76. 13s. 10d.	£78. 6s. 10d.	£56. 15s. 6d.

A renewal of the rumours in regard to hidden stocks caused a heavy break in prices early in the month. Under bear attacks and the liquidation of frightened speculative holders, values suddenly relapsed nearly £8. But for the support given by the covering of a large bear account, the fall might have gone further, as the selling was general and pressing. As it was, the recovery was substantial and has continued during the remainder of the month until three months copper again stands at £78. 10s. 0d. A feature has been the temporary disappearance of the contango, attesting to the magnitude of the bear interest.

In America the published price of electrolytic copper was reduced to 16 $\frac{3}{4}$ cents, but first hands have not sold under 17 $\frac{3}{4}$ cents, local consumers having paid this price for substantial quantities for delivery from September to November. Producers are now sold well ahead. In this country and in Europe generally the consumers' demand has not yet been active for these months, as they appear to be waiting for a more settled market. The activity at the manufacturers' works, however, is general and seems likely to increase. With the American crop prospects well assured, there is every likelihood of a large autumn demand. The shrinkage in the world's stocks still continues. The European figures on the contrary show a slight increase over the month. In view, however, of the practical exhaustion of refined copper here, this is likely to continue until the sulphate demand revives. The increased refinery capacity has been delayed beyond all expectation. Its advent is now an urgent necessity.

TIN.

Average price of cash standard tin :

July 1912	June 1912	July 1911
£202. 8s. 3d.	£205. 18s. 9d.	£193. 2s. 0d.

This market has been featureless and prices have been steady. In the absence of any decided tendency, some operators attempted to depress values, but the buying power was so considerable that an advance could only be prevented by sacrificing large quantities. Finally the demand became so persistent that the bears subsided. Although Metal Exchange transactions are restricted, strong operators appear

to be accumulating stocks, and further developments depend upon the views they hold. At the Banka auction, a keen competition resulted in the high average price of £210. 7s. 6d. being realized. The increase of 482 tons in supplies announced for June is considered favourable in view of the addition of 2640 tons of Banka to the stocks. The quantity of Banka for sale in 1913 is provisionally fixed at 1800 tons less than for this year.

SPELTER.

Average prices of ordinary brands :

July 1912	July 1912	June 1911
£25. 13s. 1d.	£25. 11s. 10d.	£24. 13s. 10d.

Trading is quiet in this country, but in America the demand is strong, consumption expanding and production being apparently at about its maximum. The syndicate advanced prices 5s. Second-hand parcels are selling under producers' figures.

LEAD.

Average prices of soft foreign lead :

July 1912	June 1912	July 1911
£18. 8s. 9d.	£17. 11s. 8d.	£13. 10s. 11d.

The position is one of continued strength. In the absence of fresh shipments, the need for replenishing supplies in consumers' works is becoming increasingly urgent, the termination of the transport strike not having released the quantities that buyers expected. Although £19 has been paid freely for August and September deliveries, a still further substantial advance seems almost inevitable. The continental demand is quite phenomenal and high prices continue to be paid. No slackening in demand is probable before the closing of the northern ports.

OTHER METALS AND MINERALS.

Prices quoted on August 10 :

SILVER.—27 $\frac{3}{4}$ d. per oz.

PLATINUM.—185s. per oz.

BISMUTH.—7s. 6d. per lb.

ALUMINIUM.—£75 to £78 per ton.

NICKEL.—£170 per ton.

ANTIMONY.—£27 to £28 per ton.

QUICKSILVER.—£8. 5s. per flask.

MANGANESE ORE.—9d. to 1s. per unit (1%).

IRON ORE.—Cumberland hematite 26s. per ton at mine. Spanish 21s. 0d. delivered in England.

PIG IRON.—Cleveland 59s. 6d. per ton. Hematite 75s. per ton.

WOLFRAM ORE.—28s. per unit (1%).

SPECIAL CORRESPONDENCE

News from our own Correspondents at the principal mining centres

LIMA.

New Railways.—The upward prices of the metals has stimulated mining activity but no notable developments have ensued as yet. Of the several projected railroads that have been surveyed the most important, as affecting the mining industry, is the continuation of the Huancayo branch of the Central Railroad of Peru to Ayacucho. This route will pass through Huancavelica and possibly attract attention to the famous mercury mines in the vicinity. The completion of the road will doubtlessly give an impulse to mineral exploration, which suffers at present from inaccessibility and consequent high rates of transport. The Ucayali railroad has been approved by Congress, and construction is expected to start soon. This road will give an outlet to the eastern or *montaña* side of Peru, and although not passing through a known mining region, it may stimulate prospecting within a wide zone. The line will start from Goyllarisquisga, where are the coal mines of the Cerro de Pasco Mining Co., and end at Pucallpa on the Ucayali river, which is a branch of the Amazon. The Arthur Koppel Co. has been granted a concession, and the survey has been made from Oroya, the junction of the Central Railroad of Peru and the Cerro de Pasco Railroad, to the Urubamba river, a branch of the Ucayali. No mineral districts exist along this route. Other surveys to eastern Peru have been made, one from Paita, the principal port of northern Peru, to Limon on the Marañon river, and the other from a point on the Southern Railway of Peru, near Tirapata to the Madre de Dios river. Both routes are likely to develop gold lodes and placer resources. The four roads that will communicate with the *Montaña* are to be narrow-gauge, one metre or less.

The copper production of the country is responding to the higher price of the metal, so that the year should show a notable increase over 1911, when the output was 28,500 metric tons. The Cerro de Pasco Co. ships about 4,000,000 pounds of copper monthly, of which a portion is from custom ore. Recently a record smelter run of 1174 tons of ore in 24 hours was made.

The Backus & Johnston smelter at Casapalca has considerably increased its output,

which is now about 800,000 pounds of copper (as matte) per month. This has been helped by the success of the sintering pots; a new furnace will be blown in shortly and double the output. Plans are under way to erect a 2000 hp. hydro-electric plant, to supply power for haulage in the mines and for moving the converters in the smelter; other minor changes are contemplated. Surveys are now being made for an aerial tramway to Morococha, probably 14 kilometres long, from which district about 300 to 400 tons of copper mineral, partly custom ore, is being received daily. Unfortunately the flooding of the pumps in the principal producer of the company, the Natividad mine, has temporarily cut off that ore supply. The shipments from the Morococha district are over 800 tons of ore daily, of which the greater part, allowing for that shipped to Casapalca, is from the Morococha Mining Co. (a subsidiary formed by the New York interests of the Cerro de Pasco Co. prior to the settlement of their litigation with the Socavonera del Cerro de Pasco) and is sent to the Cerro de Pasco smelter. It has been rumoured that more active operations will be begun shortly by this company. A 20-ton furnace has been erected in the district on an old smelter site, and is expected to serve the small producers. At Ferrobamba development work continues to be actively pushed with a view to testing the possibilities of the property. A. C. Burrage is also prospecting and developing a copper district beyond Huancayo, in the province of Tajacaya; many denouncements of coal lands are being made in connection with this project. The continuation of the Oroya-Huancayo railroad to Ayacucho will come within 40 miles of the district. An option on the Sayapullo properties is reported to have been granted to French capital, although the local people decline to accept the terms made by their representative. It is stated that the terms include £60,000 in cash and a share participation, whereas at least £100,000 cash was the minimum figure to be accepted in view of the mineral on the dump ready for shipment; local comment on the situation is lively. The mines are situated about 100 kilometres from the coast, just north of the port of Salaverry, and cover copper-silver veins from which ore has been smelted, in a 30-ton

water-jacket, and matte shipped; the deal also involves coal mines that supply fuel for smelting.

Silver.—E. E. Fernandini is producing at the rate of 1,500,000 ounces silver per year in his Huarucaca smelter. The ore is from the Colquillisca mine and is smelted with copper ore from the Santa Catalina mine at Cerro de Pasco, to make an argentiferous matte, only sufficient copper ore being added to act as a collector. The Doceña mine at Cerro de Pasco is shipping about 8000 tons of ore monthly to the local smelter; this, at present quotations of copper and silver, is said to yield the owners £30,000 net profit; the ore carries gold up to one ounce per ton.

In Gold Mining the operations of the Aporoma Goldfields, Ltd., have been going on several months and a clean-up has doubtless been made by this date. The hydraulic plant is said to have given satisfaction. This is probably the largest placer mine in Peru and its success will attract much attention to this branch of mining. Prospecting for gold in the bed of the Santa river, which debouches just north of Chimbote, has been begun; natives are said to make a living by crude washing of the gravel. The Nueva California placer fields, inside from Chala, in the province of Aymares, are to be investigated after many years of inactivity. In vein mining some activity is also indicated. A promising prospect has been denounced close to Huanuco, near the route of the Ucayali railroad, which is at present somewhat inaccessible, but the building of the railroad will relieve the situation. In the Potaz district, some development is being done and a small stamp-mill, which has been lying in Chimbote for several years, will be utilized. The New Chuquitambo Gold Mines, near Cerro de Pasco, have been operating the recently completed cyanide plant (the first of its kind in operation in Peru) in conjunction with its 40-stamp mill; the cyanide plant will handle the accumulated tailing as well as that now being made. The monthly output has been stated as 29 kilo. of bullion.

Near the Cerro de Pasco smelter two small cyanide plants have been erected to treat the large tonnage of low-grade silver tailing left from the early arrastra operations.

Zinc.—The spelter resources of the noted Carahuacra mine, once famous for its silver ore, have been investigated for account of Aron Hirsch & Sohn and the Minerals Separation, Ltd. The flotation process of the latter company appears adaptable for the commer-

cial recovery of the silver and zinc contents. The present company (Sociedad Minera de Carahuacra, Ltd.) is treating the dump ores and selected argentiferous zinc ore, by pan-amalgamation, effecting a recovery of 60% of the silver content.

General.—The two tungsten properties that are being developed in the Conchucas district have been making small shipments of hand-picked ore and hand-jigged concentrate; small mills have been erected on both properties, but no trial runs have been made as yet. Interest in vanadium prospects has not been entirely dropped, but is of less extent than last year. The newest developments have been near Huanuco, the coal ash averaging 25% vanadic oxide. Emerald deposits are stated to have been found near Cuzco, and nitrate fields are said to have been discovered in from Chala which have been taken over by American interests. Definite news regarding both is meagre.

Of passing interest is the completion and successful operation of the wireless telegraph between Lima and Iquitos. The latter is at the head of the navigable waters of the Amazon and 1030 kilometres in an air-line from Lima, the high ranges of the Andes and the tropical forests of the Montaña intervening between these points.

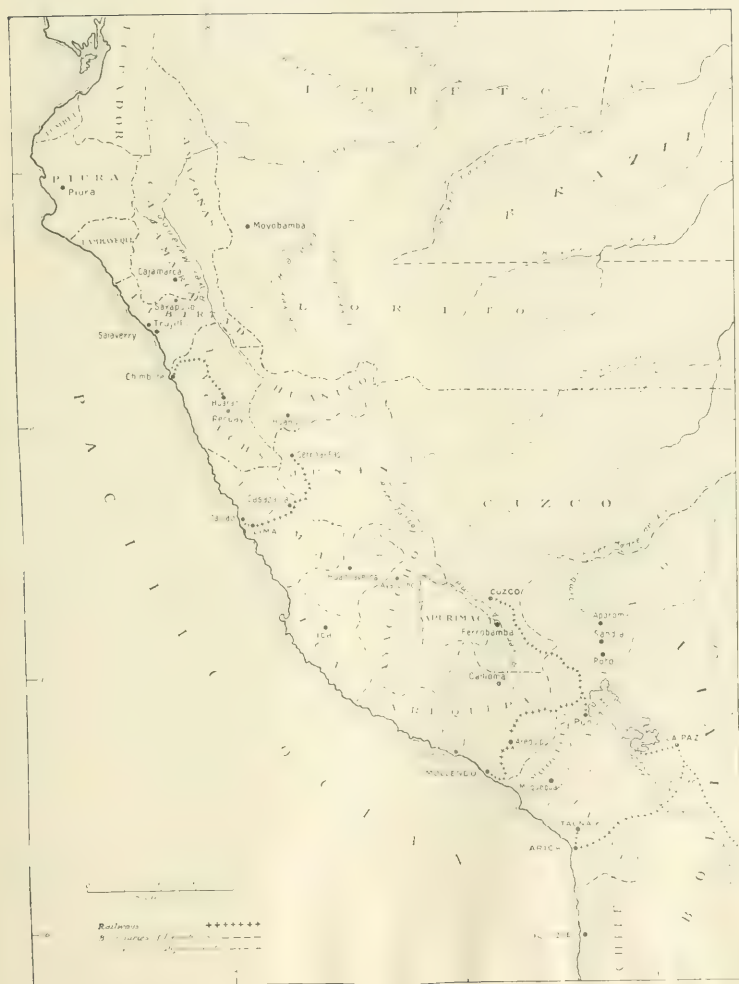
VANCOUVER.

British Columbia.—A report issued recently by the Provincial Department of Mines places the various mining districts of British Columbia in the following order as regards value of mineral production in 1911:

District	Value of Mineral Production
Coast	\$10,579,086
Yale	5,621,109
West Kootenay	4,343,912
East Kootenay	2,475,056
Cassiar	293,442
Cariboo	180,000
Lillooet	6,467

Total for 1911...\$23,499,072

The disproportion between the Coast and other districts is attributable to the fact that nearly all the miscellaneous products of the year, such as building stone, brick, cement, etc., included in the total of \$3,547,000 for that class of minerals, came from the Coast district, while the value of its coal output in 1911 was \$5,688,000, leaving but a relatively small amount as the total value of its metaliferous mineral production for the year. On



the other hand, the Boundary portion of Yale district is credited with \$4,745,400, and West Kootenay \$4,271,000 as their respective proportions of the total value of metallic mineral products. These district totals compare with \$1,534,000 for the Coast, \$853,000 for East Kootenay, and \$477,000 for all other parts of the Province; the total value of its metaliferous production in 1911 having been \$11,880,000. These various figures in considerable degree show the relative importance of the several mining districts as regards their production of metallic minerals, notwithstanding that last year, owing to the coal-miners' strike stopping the supply of coke for five or six months, as affecting Boundary district, and other causes in the case of West Kootenay, there was a decrease from the 1910 production, which was—Boundary \$6,442,000 and West Kootenay \$5,088,000.

Boundary Mines.—The important mining operations in Boundary district are those of the Granby, British Columbia Copper, and Hedley Gold Mining companies. The Granby Consolidated Mining, Smelting, and Power Company's fiscal year, which ended June 30, has to its credit a smaller output of ore and production of copper than any other year since 1905. The decrease took place, though, in the latter half of 1911, for during the greater part of the expired months of 1912 the mines and smelter have been operated to full capacity. While the figures of the fiscal year are not exact, those for June being approximate, and the quantity of copper the production of 'blister' not 'fine' copper, they show in a general way the last year's results. For purposes of comparison the following table is given:

For Fiscal Year to	Granby Ore Tons	Copper Lb.
June 30, 1910...	1,175,548	22,754,899
June 30, 1911...	950,563	17,858,860
June 30, 1912...	731,674	13,424,525

As the production of the six months of 1912 to June 30 was about 630,000 tons of ore, it will be seen that this is at the rate of a larger quantity per annum than in the first above-shown fiscal year, which was the year of biggest output in the history of the company.

It may be remembered that Otto Sussman, of New York, in his report which in that year led to such a serious depreciation in the market price of Granby Co.'s shares, included the following among his conclusions: "The ore reserves developed by underground workings and diamond-drill holes within the territory owned by the Granby Company in the

camp of Phœnix, amounted on March 1, 1910, to about 5,100,000 tons. This estimate takes into consideration a stoping loss of about 10% of the original contents of the orebodies, and the above figure consequently represents ore that can be recovered." As the company's mine superintendent estimated 6,429,000 tons of ore blocked out, and added: "We hope to mine and ship 90% of all ore developed," the difference between the two estimates was small; consequently the company's figures may be taken as representing approximately the situation, which at the end of June, 1911, was that during the fiscal year 291,000 tons more ore had been developed than mined and shipped. This would make it appear that at the end of June, 1912, there was still an excess of 5,000,000 tons of 'developed' ore in the company's mines at Phœnix. The net profit for the fiscal year ended June 30, 1911, with copper at an average realized price of 12'32c. per lb., was \$217,415. As the average New York price for copper for the expired six months of 1912, during which the company has made equivalent to about six-sevenths of its last fiscal year's production, has been three cents a pound higher, there would appear to be a good margin of additional profit to much more than offset the maintenance charges loss during the five non-productive months of the year. It may be added that the price of the company's \$100 shares has recovered from a lowest quotation of \$20 in 1910 to a present market value of about \$55 per share.

The British Columbia Copper Company appears to have well maintained production during the first half of 1912, as compared with its last fiscal year, ended November 30, 1911. The receipts at its smelter during the expired six months of the current year have been approximately 312,000 tons of ore, all but a few thousand tons from its own mines together with that from those of the New Dominion Copper Co., in which it has a majority interest. These figures for half the year compare with about 604,000 tons for the whole of the last fiscal year, when production of metals was 9,944,987 lb. fine copper, 31,144 oz. gold, and 134,266 oz. silver. An estimate of production of copper during the last six months may, therefore, safely be made at nearly 5,000,000 lb., for there is little variation in the grade of ore mined in successive years. Ore receipts for the last six months were approximately 193,000 tons from the company's Mother Lode mine, 106,000 tons from the New Dominion Copper Co.'s Rawhide mine, and 13,000 tons from several small

mines. In June the directors declared a dividend of 15 cents a share on the 596,700 issued \$5 shares of the British Columbia Copper Co. This was dividend No. 4; it amounted to \$88,756, and was payable on July 15. In announcing this dividend the directors stated: "The company has in hand a fund sufficient to pay a full year's dividend at the rate declared today (12% per annum) on the par value of the shares." The comment of a New York publication is: "This means that the company is earning more than double the current dividend requirements." The aggregate of the four dividends paid by this company is \$437,887.

On June 29 Edward George Warren, the company's general manager was so severely injured in an automobile accident that he expired four days afterwards. Frederic Keffer, the company's geologist and mining engineer, has been temporarily appointed acting general manager.

The Hedley Gold Mining Co., which, like the Granby and British Columbia Copper companies, has its head office at New York, has this year paid two quarterly dividends of 5% on its issued capital of \$1,200,000 in shares of \$10 each. Last year this company paid four dividends totalling \$300,000, or 25% on its issued capital. Three were quarterly dividends of 5% and the fourth of 10%. Its production from its Nickel Plate group of mines, situated near Hedley, in the Osoyoos mining division, was 57,815 tons of ore of an average assay-value of gold \$11.99 per ton. An extraction of 94% was made; total expenditure was \$370,814 and total profit \$308,802—equal to \$5.34 per ton net profit. The ore is crushed in a 40-stamp mill. No gold is saved on amalgamation plates, but the concentrate from Wilfley tables is sent to a smelter, and the slime from Deister tables receives cyanide treatment followed by extraction of solution by an Oliver filter-press and saving of gold in Merrill precipitation-presses. Production for six months to June 30 is stat-

ed to be up to the average of 1911. The company has in its mines large reserves of ore of similar general grade to that above mentioned.

West Kootenay.—By far the larger part of the total mineral production of mines in the extensive West Kootenay district comes from those at Rossland, in the Trail Creek mining division. The proportions for last year were: Trail Creek, \$2,892,000; Slocan



and Ainsworth, \$875,000; Nelson, \$509,000; other parts, \$68,000; total, \$4,344,000. Over the five-year (1907-1911) period, the value of production from these several parts of the district was similarly disproportionate, as follows: Trail Creek, \$15,496,000; Ainsworth and Slocan, \$5,694,000; Nelson, \$3,047,000; other parts, \$606,000; total, \$24,843,000.

During six months to July 1, 1912, the approximate ore production of Rossland mines was: Centre Star Group, 78,000 tons; Le Roi, 24,000 tons; Le Roi No. 2, 21,000 tons; total, 123,000 tons. The Consolidated Mining and Smelting Co. of Canada owns the Centre Star group, which comprises the Centre Star, War Eagle, Iron Mask, and other adjoining properties. Last year it acquired the Le Roi group, so that now it has the greater number of the producing mines of Rossland. Some particulars of these will be supplied after a visit to Rossland, to be made in July.

Slocan and Ainsworth divisions of Slocan district are experiencing a revival of mining activity, and the outlook is distinctly favourable. In the Silvertown or Four-mile camp, near Slocan lake, in the western part of the district, the larger producers of silver-lead-zinc-ores are the mines of the Standard Silver-Lead and Van-Roi companies, while the Silvertown Mines is continuing to do important development work in its Hewitt-Lorna Doone mine. The Standard company was organized about eighteen months ago, after the mine had been developed by private owners to a stage where power for mining, an aerial tramway for transportation uses, and a mill for concentration of ores, were essential to profitable operation. These, and a water-supply system for compressor and mill plants, were provided last year, at the close of which production of ore was commenced on a much larger scale than during the earlier development period of the mine. Results have been such that in April a first division of $1\frac{1}{4}$ cents per share on the 2,000,000 \$1 shares was paid, and since then three monthly dividends, each of $2\frac{1}{2}$ c. per share, have been paid, making a total to July, inclusive, of \$175,000. Ore reserves are large enough and prices of metals sufficiently high to justify the expectation of continued distributions of profits for some time to come.

As first-hand information relative to the Van-Roi and Silvertown Mines companies (both British proprietaries) will be obtained shortly, no further reference will be made to them at this time, except to mention that quite lately it was stated another important ore-shoot had been found in the Van-Roi mine, and that M. S. Davys, managing director of the Silvertown Mines, Ltd., had arrived at the Hewitt-Lorna Doone mine from England and will give early attention to the matter of providing concentration facilities, which are needed since the Wakefield mill, formerly leased by his

company, has been destroyed by fire.

Probably the most momentous intelligence concerning mining in Slocan district that has been made public in recent years is that of the fact that ore of excellent grade has been found on the 1400-ft. level of the Rambler-Cariboo mine. This property was discovered in 1892; since then, to the end of 1910, approximately 23,384 tons of ore, containing 2,216,800 oz. of silver and 13,676,885 lb. of lead, has been shipped. Prior to 1904, \$230,000 was paid in dividends. By this time the mine had been worked to a depth of 800 ft. below the outcrop of ore to 300 ft. depth by adits and thence down to 800 ft. by levels opened from a shaft sunk from the 300-ft. level. The power plant in use having been found inadequate to pumping and hoisting requirements down to the depth reached, it was eventually decided to drive a long cross-cut, at 650 ft. below the 800-ft. level. This work was commenced in July, 1904; by May, 1906, a distance of 4500 ft. had been driven, dimensions of adit being 9 ft. 6 in. high by 7 ft. wide. The contract price for the first length driven—2500 ft.—was between \$10'50 and \$11'50 per foot, this price including everything but compressed air for drills, which the company supplied. The remaining distance was done on day-work. The cost of the entire cross-cut, including management and all other expenses, was \$14'60 per foot, and the rate of progress made was 7 ft. 3 in. per day of 24 hours. Where first found on this level, the vein did not contain ore, but, at 200 ft. the rise disclosed the presence of streaks of galena in an 8-ft. vein. After connection had been made with the old 800-ft. level and the mine drained, exploration was undertaken and shoots of ore found on successive levels from the 700 down to the 1200-ft. level. Quite lately the 1400-ft. level entered a shoot of high-grade ore at a point about 100 ft. short of where the big shoot opened on the 1200-ft. level is expected to be reached, so the former is regarded as being a new orebody not cut above. Now, the construction of an aerial tramway from the mine to the mill, and equipment of a concentrating mill built alongside a branch railway line that the Canadian Pacific Railway Company has lately made to connect with its Nakusp-Sandon line, are in progress, so with large reserves of ore, convenient transport facilities, and suitable concentrating plant, the Rambler-Cariboo company expects shortly to enter upon a period of continuous profitable production.

On the Slocan Star an adit, to be about

2300 ft. long, is being driven in the expectation that the ore-shoot occurring in upper levels will be found at 650 ft. greater depth. Progress is at the rate of 10 ft. a day, and 1600 ft. had been driven by the end of June. A similar work is in hand at the Payne mine, which was discovered in the early nineties, and during about twelve years produced approximately 50,000 tons of ore having a gross value of about \$4,000,000, out of which dividends to the extent of \$1,438,000 were paid before suspension of mining in 1904. Another deep development was recently facilitated by completion of a rise from an adit 1100 ft. below the surface to the 300-ft. level of the Surprise, at Cody. Construction of the C.P.R. branch line from Three Forks to Bear lake, now nearly completed, will admit of the shipment of much zinc ore from the Lucky Jim mine, in which development work has been maintained for several years.

The Whitewater group, in Ainsworth division, is being further developed by Retallack & Co. Exploration in the Deep of this property has not yet resulted in ore being found in quantity. An adit has been driven 1800 ft. and the vein reached at a vertical depth of 1500 ft. below the outcrop and about 2000 ft. on the incline. It has been determined that the vein is nearly vertical and 50 to 60 ft. wide in the Deep, but where explored is practically unproductive. In the old Whitewater mine, which is the outcrop of the Deep, J. L. Retallack has reported the outlook for ore to be favourable. He wrote: "At one point, about 900 ft. from the surface longitudinally and 600 ft. vertically from the outcrop, we have a very fine showing of high-grade ore, which looks as if it might be the bottom of another important ore-shoot. Taking it altogether conditions at Whitewater are very healthy.

The New Canadian Metal Co. has resumed work at the old Bluebell mine, on Kootenay lake, S. S. Fowler continuing as general manager. Hoisting and pumping machinery have been put in, and treatment capacity of the concentrating mill enlarged. At Ainsworth proper, formerly known as Hot Springs, the Consolidated M. & S. Co. is developing the No. 1 mine, and quite recently it bonded the Highland mine and mill.

In the Nelson mining division, several lode-gold mines are producing, also one lead mine. These are the Granite-Poorman, near to the city of Nelson; the Queen and Motherlode, at Sheep Creek—the latter having lately commenced operating a 10-stamp mill equipped with thoroughly modern gold-saving appli-

ances—the Emerald lead mine, and others. The alleged discovery of platinum metals at the Granite-Poorman group has not been confirmed by the Provincial Geologist.

Removal of Frank.—The mining town of Frank, in Alberta, which was the scene of a disaster caused by a land-slide in which many lives were lost some years ago, and which is again in danger from the same cause, is to be removed. Tenders have been called for in connection with the removal of all buildings to a safer site. This will be a serious undertaking as the town has experienced rapid growth latterly.

NEW YORK.

The recent break of a few points in nearly all stocks does not seem to have been caused by alarming factors. General business conditions are most satisfactory. Crop reports are decidedly favourable, rains having been heavy in districts where they were most needed. The political situation should no longer cause any great anxiety, and in fact it is difficult to find any factor in the present situation that appears portentous of industrial depression. It is probable that the break in the market may be largely attributed to a mid-summer dullness that has followed the excitement of the Republican and Democratic conventions.

The renewed buying on a large scale by the railroads is an encouraging factor. There is no other purchasing form that can compare with the railroads for stimulating activity in all lines. Previous to the last few years it was usually customary to figure that 40% of the steel products of the country were consumed by the railroads. If, with an almost complete cessation of railroad buying, the steel companies have been able to make a living, then, with the railroads again in the market, the tremendous output of steel required should insure production at the highest capacity and at rising prices, for at least the remainder of the year.

According to the report of June 30, the United States Steel Corporation finished the first half of 1912 with unfilled orders amounting to 5,807,346 tons, an increase of 56,363 tons over the previous month, and of 722,285 tons since the beginning of the year. The gain for the year was not large, but in connection with the heavy production it represents continuation of a strong buying demand, which has enabled the Corporation to close a half-year of almost record output with a gain of three-fourths of a million in unfilled ton-

nage. This is only the second time in 9 years that the United States Steel Corporation has shown a gain in unfilled orders during the June quarter.

As to copper, it appears that the recent scare was without substantial foundation. The producers' statement shows a further decline of 5,000,000 pounds. Reviewing the first six months, there is shown a gain over last year in production of 10,000,000 lb., or 1.4%, and in total deliveries of 90,000,000 lb. or 13%. The increase in production is surprisingly small, yet it is not reasonable on this account to question the integrity of the figures. A close analysis fails to reveal any substantial ground for believing that there has been an increase in production of over 100,000,000 lb. in the half-year. While it is true that some new production has been coming into the market, it must be remembered that several of the older districts have made no increase whatever and some have actually decreased. The state of Michigan, for instance, produced if anything less copper in the first half of 1912 than in 1911. Much of the new production is required to make good such deficiencies. It would be practically a physical impossibility to increase the production in six months to any such extent as the consumption has increased, namely, 13%; consequently, a large shrinkage in surplus stock must have taken place. As to the future, it appears that a runaway market has been prevented, which is what those most interested in the welfare of the copper industry have devoutly desired. Just now is between seasons. Many of the large consumers have contracted for their present needs and will probably not be in the market again until the uncertainties are cleared; consequently, it is quite possible that considerable blocks of copper may change hands at a price of a cent or so under the recent high figure. From Butte came the word that the Amalgamated Copper Co. was entirely sold throughout July and August. As this company controls the United Metals Selling Co., the statement was taken as an indication that all other producers marketing their output through this medium were likewise in a strong position. That there is always a large tonnage of unrefined copper in transit and held in reserve at refineries will be admitted by the producers, but such a condition is necessary. It has been estimated by an exceedingly good authority that there is above ground 100,000,000 lb. in unrefined and unmarketable form. That is where the copper surplus exists, but it would take several months to put it into marketable shape.

JOHANNESBURG.

Lower Dividends and Higher Costs. —

The reduction in the aggregate dividends from Rand gold-mining companies, for the first half of 1912, to £3,750,000—equivalent to a fall of £330,000 as compared with a corresponding period in 1911 and of £600,000 as compared with 1910—has given rise to a little serious contemplation of recent reforms and tendencies. This is both timely and beneficial. Expressed in the most kindly terms, the controllers of the industry during the last year or so have evinced excessive zeal. The cry has been in all quarters for reform, and men with all the necessary energy, thoroughness, and strength of will have been endeavouring, according to their several ideas and aptitudes, to effect the improvement in underground methods and organization. Yet costs have been steadily rising and profits going down. There is now, in the reaction, a too-prevalent tendency of critics to blame 'coal-mining methods'; some even going to the absurd extreme of associating fluctuations in the accident-rate with the more extensive introduction of colliery principles. But the conflicting forces to which the industry has been submitted of late admit of no such simple diagnosis of its infirmities. It is as though some eminent man has been declared sick, and the call had gone forth for fresh medical aid, to rouse the family physician from his mental slumbers. The local man, acquainted with the weaknesses and failings of his patient by many years of close observation, is pensioned off and the new advisers—throat specialists, oculists, bone-setters, and other experts in special departments of work—take charge of their victim. Truly he is indisposed. He has been ill attended to or even "grossly neglected." Then the sufferer is given phosphate diet by one, new glasses by another, an ear-trumpet by a third, a plank sleeping-bench by a fourth, Sandow exercisers by another, while an ardent medical student employs a vibro-electric treatment of his own invention. The patient ungratefully gets worse, and, after a year or two of quiet submission, sadly asks whether his little attack of indigestion, due to excess of unnutritious food, demanded such violent treatment. So is it with the Rand today, after a long period of dangerously 'progressive' treatment, introduced to check symptoms of congestion through the over-feeding of its mills with low-grade ore. Now that the results have proved disappointing, there is natural confusion of opinion in the allocation of blame. There is no doubt that the vigorous upheaval

of so-called 'old methods' has had a good effect in many directions, vividly establishing the principle that there must be no stagnation in mine management, but it has been too chaotic in its conception to give results capable of proper analysis. New ideas should always be introduced under the guiding influence of experienced Rand mining or metallurgical engineers, who can provide the solid basis of knowledge from which alone experimental methods can safely spring.

In the last few years, too much pioneering has been done and it has cost much money. While efforts have been made in certain districts to attain higher levels of efficiency in schemes of development, in haulage methods underground, in ventilation and in allaying dust (improvements along lines admitted by all to be most desirable), the great economic fundamentals have been sliding into comparative neglect. The seeming 'details' of underground work have not been improved and the cost of winning ore has been going up. The supreme importance of maintaining or improving the efficiency of every-day routine work has been obscured. Never has the danger of going to extremes been more clearly demonstrated upon the Rand than in recent times, and it is probable that the present recognition of the need for progress only on cautious lines will lead to genuine improvements in the near future.

Failure of the Benoni Plant.—The report of the annual meeting of the Benoni Consolidated, at which there passed volleys of recriminations between sections of the board and the consulting engineer, makes unpleasant reading. The company has got into serious financial difficulties, its new plant constructed on lines of experimental metallurgy has been closed down, and £75,000 is required to make a fresh start with a re-organized plant. Such a situation scarcely promised to provide the background for a peaceful meeting, but few expected the exposure of complicated maladministration that followed. In the attack by S. C. Black upon E. J. Way (consulting engineer), in Mr. Way's reply, in Sir George Farrar's 'diplomatic' commentary, and in other contributions to the discussion, there is so much difficulty in determining who has attempted evasion of responsibility and who expresses righteous indignation that further opinions may well be withheld, until we see what is going to be done by directors to put things straight. The principal innovation in the reduction plant was the Arbuckle process, by which the settled slime was to be removed

from settling-cones by an ingenious screw. The method had been inadequately tested on a working scale and it failed in the Benoni cyanide works to perform its functions satisfactorily. Mr. Arbuckle claims that failure resulted from the departures made from his original designs. Mr. Way declares that Mr. Arbuckle never visited the plant during its construction and that the staff were appointed by the board over his head, robbing him of proper control over its work. A lengthy wrangle is proceeding, of little satisfaction to suffering shareholders, who have seen their stock fall from 36s. to 6s. Shuffling of responsibility is at all times an ugly process. Mr. Way, as is right, has accepted the bulk of the load and only asks the critical directors to take some of the weight instead of increasing it with mud. What shareholders can now alone seek to know is the extent to which the controlling firms are prepared to finance the mine into a new existence, now that the schemes introduced with the approval and cognizance of the Board have proved a costly failure.

New Underground Contracts.—A few of the leaders of the Miners' Association are endeavouring to stir up a wide agitation against the new form of underground contract, to be introduced for general adoption along the Rand from August 1. As few miners understand exactly how the new agreement will affect them, the agitation is at present artificial; but there is scope for plenty of misrepresentation in its discussion by the Union officials, who are, however, at present clumsily 'feeling the way.' The new agreement is the issue of attempted standardization of contracts and it involves the reduction of all charges for stores and labour to contractors at common rates, practically at cost. This means that the majority of companies will have to cut down contract prices, which will be little relished by the men until they learn the true influence of the reduced items on the debit side. Whether the change has been wisely made or at an opportune moment is open to question. Attempted standardization among the groups has too often been tried and too often broken down in regard to coloured-labour wages to allow of immediate enthusiasm over the proposal.

In conjunction with the new agreement, which is stringent in its conditions, there is being introduced on some mines a guarantee of a fixed day's pay, should the contractor come out in debt. That this provision should be strongly criticized by the miners' leaders, while others of undoubted severity are ignored,

indicates to what a poor level of intelligence the Association's committee has fallen in recent years.

Small Machines.—The development of the use of small machines of the reciprocating type in stoping has conclusively proved that the long and costly competition of 1908-'09 was not held in vain. Now that the increased demands for air power have been met, to some extent, by the central stations of the Power Company, the increase in the adoption of small machines—notably the Holman, Siskol, and Ingersoll—has been manifest in all big mines, with results that generally compare satisfactorily with hand labour. Ample hammer-boys are not available, however, so that comparisons in cost often have little practical value.

The progress made with small machines at the Robinson Deep is remarkable. The manager, in his annual report, draws attention to the following comparative results:

	1911.		1912.	
	Fathoms broken	Fathoms per shift	Fathoms broken	Fathoms per shift
Hammer-Boys	10,956	0 076	6,583	0 072
Small Machines...	12,884	0 55	22,657	0 701
Large Machines...	11,662	0 63	9,096	0 760

The progress recorded in total fathamage and in efficiency is exceptional. Nevertheless, many other mines could record big improvements. Not only are the small reciprocating machines steadily gaining ground, but hammer-drills are again winning favour for stoping. Hammer-drills, with tail-piece extension, for drilling back holes—as the Waugh, Ingersoll, and Shaw—are being more widely used in steep back-stopes, while an effort is being made, with success in a few mines, to extend the application of the hand hammer-drills (Climax, Ingersoll, Flottmann, etc.) using hollow steel in ordinary stoping conditions.

Technical Papers.—At the last annual meeting of the S.A. Institute of Engineers, the council came in for a good deal of friendly criticism from J. W. Kirkland for their excessive attention to the "machinery" of the organization—to the finances and administration of the Institute—while the brain output in the form of papers and discussions was comparatively disregarded. It is certainly true that this society devotes more time to formalities and questions of policy and control than others domiciled in Johannesburg. Probably it has greater difficulty in obtaining contributions. The Geological Society is supported by members of the Government Survey and also by

several geologists who have ample time and opportunity for publishing the results of their field investigations. The Chemical, Metallurgical & Mining Society has such a wide and strong membership that its difficulties are, one would gather, more in the matter of selection and rejection than of attracting papers and discussions. At the same time there is a gratifying solidity about the proceedings of the Institute of Engineers that gives them particular merit, and it is to be hoped that criticisms offered by its more energetic members (who should emphasize their views by providing more of the technical brain-food needed) will not lead to greater quantity at the expense of quality.

Training School for Miners.—The training school for miners instituted under Government auspices at the Wolluter gold mine has met with only a small measure of success, in spite of the most energetic advertising. The scheme has been to give lads a thorough three-years course of underground work of all kinds—machine and hand-stoping, timbering, pipe-fitting, track-laying, etc. A young man passing through the course would undoubtedly receive a better grounding in his work than could be attained under any ordinary conditions, but unfortunately nearly all young workers coming in contact with Rand mining life are influenced too keenly by the attraction of immediate pay and fail to appreciate the future worth of a well-grounded experience. At the training school the pay only reaches 6s. 9d. per day at the end of the course—that is, during the last quarter of the third year; yet this amount can be earned by tally lads, trammers, and machine learners upon other mines during the first three months of their underground experience. Few lads in this country have the patience to wade through the prescribed course of technical education when they think they can gain similar experience elsewhere, with a little more risk, at higher wages. Some mining men even consider that a lad must be lacking in energy and self-confidence to be attracted by such a three-years term of 'spoon-feeding,' when the knowledge can be gained in less time and with greater reward in the rougher and more effective school of practical mining where the spirit of self-reliance and an aptitude to face unexpected difficulties are likely to be more readily cultivated. The pay offered at the Miners' Training School rises from 4s. 3d. to 6s. 9d. per day, with a deduction of £3. 5s. per month for board and lodging. Bonuses are offered for special work.

Prevention of Phthisis.—This matter has been mentioned in several recent letters, and it is discussed again because it continues to hold a leading place among affairs of decided topical interest. The efforts now being made all along the Rand to allay the dust are not a mere spasm of ardour and enthusiasm, such as has been often devoted to technical problems in the past, only to die out after a few months, or weeks, of artificially excited interest. There is earnest competition among mines to attain efficiency of method, and the task of the Government officials called upon to enforce the regulations is daily becoming less exacting. Much still remains to be done by way of improving methods for allaying the

acetylene lamp, which, with water under pressure, creates a beneficial spray. Two are ample for one drift. The simplicity of any atomizer requiring no compressed air for its operation is a strong feature in its favour.

SAN FRANCISCO.

Nevada has become an important copper-mining State. As recently as five years ago it was not even mentioned in the list of the principal productive States, while in 1911 it was fifth, with a production of 65,500,000 lb. copper, nearly all of which came from a single mine, the Nevada Consolidated. During 1912 the output should be considerably increased, for the Giroux, which adjoins the Nevada Con-



BLINOCK, NEVADA

fine dust in suspension, created by blasting. A great deal of experimental work, however, is being undertaken to this end, by Government and by mine officials, whose co-operation gives good promise of a satisfactory solution of dust problems on reasonable lines, in keeping with economic conditions and yet as stringent as the seriousness of the situation demands. The dust question is nothing new. But the point is that there has never before existed the same determination on the part of those in control to adopt effective dust-allaying devices and, what is more important still, to see that they are properly utilized. At the Simmer Deep experiments have been undertaken by the manager, H. S. McGregor, with various types of sprays for checking the dust in drifts after a blast. The most satisfactory form of atomizer employed for this purpose has been curiously the ordinary burner of an

solidated, has begun shipping ore to the concentrator of the latter company, and the Nevada Consolidated has re-opened its Veteran mine, where the ore is higher grade than in the open-cut workings. The Mason Valley and Nevada-Douglas mines have also begun regular production, the smelter of the former treating 700 to 800 tons of ore per day, taking approximately equal quantities of ore from each of the two mines. This gives an excellent smelting mixture; so good that the 400-ton blast-furnace is regularly smelting nearly twice its normal capacity. The Nevada-Douglas is at some distance from the smelter and there are persistent rumours that it will build its own plant, but it is at least doubtful whether the lessened haul would compensate for the forfeited advantage of an easy smelting mixture. The Bluestone mine, which adjoins the Mason Valley, is on the

market, and there seems to be some competition for it, so the control is likely to pass soon. This is the oldest property in the district, and in the heyday of the Comstock it served to furnish some of the bluestone necessary for the Washoe process. The property has many points of interest; it is owned by J. R. DeLamar, who is reported to have spent \$350,000 in developing it, but prefers to sell rather than to operate the mine. The ore is chalcopryite, associated with epidote in a garnetiferous limestone, and an extensive series of experiments has demonstrated that, as reported, 95% of the copper can be recovered in the form of concentrate by magnetic separation on Wetherill machines, after subjection to a light roast. A good deal of money is being spent upon the development of other properties, both near the Nevada Consolidated, which is in eastern Nevada, and in the Mason Valley district, which is in the extreme west of Nevada.

As a producer of gold and silver Nevada holds the record by containing within its borders both the mine that produces the largest quantity of gold and pays the largest dividends, as well as the two silver mines that produce the largest quantity of silver and pay the largest amount of dividends therefrom; the comparison being limited to the United States throughout. The Goldfield Consolidated mine paid over \$7,000,000 in dividends in 1911 from 338,000 tons of gold ore containing a little over \$30 per ton. The natural inference is that this is too good to last, and such an inference is true, for the management has judged it necessary to reduce the dividend rate recently. While no official statement of ore reserves is issued, the manager stated that apparently there was two years supply of ore available at the first of this year and the shares are priced upon that basis. The reduction of the dividend had been expected so long that when it was announced it had little effect on quotations. On January 1, when the dividend rate was 50 c. per share quarterly, the quotation was \$4'25; now, when the rate is 30 c. quarterly, the shares are selling around \$4. Perhaps the strong price of the shares is attributable to the fact that, although the grade has decreased to \$18 per ton, the tonnage treated is being increased monthly. The Goldfield Deep Mines Co. was formed last year to sink a deep shaft and explore a large area that promises to contain orebodies in depth. The chief interests in the company are those that control the railroad into Goldfield, and if the venture is successful it will

yield a double return by increasing the traffic over the railroad line.

The big silver mines of Nevada are at Tonopah, where the Belmont and Tonopah Mining Companies furnish the larger part of the annual output of 10,000,000 oz. silver, though a number of smaller companies contribute materially to the total. The Belmont company mined and milled ore worth \$856,000 during the quarter ended May 31, at a net profit of \$450,000. The surplus of this company is now about a million dollars. A new mill has been completed and has recently been started; the old mill is being utilized by the Jim Butler. The Tonopah Merger Mines Co. is sinking a deep shaft, which has reached a depth of nearly 1000 ft. and has passed through a 30-ft. vein, 12 ft. of which averaged \$25 per ton, so that the mine promises well to develop into an excellent property. The Montana Tonopah is also doing well, the clean-up for the month of June from 4656 tons milled having yielded 3900 oz. of bullion, worth \$45,000, and 35 tons of concentrate. The McNamara is another good small property and is milling about 70 tons per day of ore, yielding about 2000 oz. of bullion, worth \$20,000 monthly. On the whole Nevada may very well be proud of its metal production.

Politics is absorbing much attention in California as elsewhere in the United States. The Westerners are generally radical and there is not much question but that of the three candidates for the presidency now in the field, W. H. Taft, Theodore Roosevelt, and Woodrow Wilson, the first is the least popular. The practical question in the West is how far Mr. Wilson, who is a Democrat, will be able to attract the dissatisfied Republican voters. To be elected he must have the full Democratic strength and must receive approximately a million Republican votes. With Mr. Roosevelt in the field the result is far from certain. Mr. Wilson is quite progressive enough to satisfy the most radical, but he must contend against the personal popularity of Mr. Roosevelt and a widespread feeling that neither of the existing parties is to be trusted to carry out the promises of its platform. It is pointed out that despite his nomination and the radical resolutions adopted at Baltimore, Mr. Wilson is being supported by Tammany and all the old-time Democratic politicians. The early expectation that these would desert to Mr. Taft, the conservative candidate, seem not likely to be realized. It is much too early to predict the outcome, but the experienced politicians in the Democratic party are much

too sure of controlling the distribution of loaves and fishes after next March to take chances by deserting. In the meantime legislation at Washington makes little progress. It is announced that the President will veto the new metal tariff even if it be passed, so no change is likely. One bit of legislation that is said to have good chance of passage is a 'home-rule' bill for Alaska. The bill provides for a local legislature of 16 members, 4 from each judicial district. It is also likely that in the naval appropriation bill a sufficient sum will be included to permit opening of the coal lands. That is a rather roundabout way to settle the



The big open-cut in the Alaska Treadwell, as it was formerly worked.

controversy, but by such routes legislation comes.

Alaska mines and mining are much to the fore along the West coast these days. Annual reports from the Treadwell mines have recently been issued and show the same steady progress and record of good work. Since the reports are available in London they will not be reviewed here other than to note that they again show what is possible when the right man and the opportunity meet in the Far

North. In Silver Bow basin, back of Juneau, there is a belt of black slate with many stringers of gold-bearing quartz that is widely believed to afford the basis for a second Treadwell. At the north is the Ebner mine, which, as related in an earlier letter, came to grief last year and is in the hands of a receiver. Next is the Alaska-Juneau, toward which F. W. Bradley and associates are now driving an adit from near Juneau, and which, if the showing when the adit reaches the lode is favourable, will doubtless be developed on a large scale. Still farther south lies the Alaska-Perseverance and beyond that the Sheep Creek properties. The Perseverance is certainly a large property with a wide lode and conditions favourable to cheap stoping. Water is scarce, the season short, and the grade of the ore low. For various reasons the company owning it has not been successful and the death of Col. W. J. Sutherland has brought about a change in control. The man now in charge is B. L. Thane, an experienced and capable mining engineer, who is already familiar with mining conditions in the region through his connection with the Kensington and Eagle River mines north of Juneau. It is hoped that Mr. Thane, and his associates, among whom is W. P. Hammon of San Francisco, may have better fortune than those previously operating the Perseverance. The fact that important Sheep Creek properties are also in Mr. Thane's hands will increase the chance of success.

Farther west conditions are promising. At Katalla the Amalgamated company has increased the capacity of its small refinery and several wells are being put down. Stephen Birch estimates that the Kennicott Mines Co., operating the Bonanza, will ship 40,000,000 lb. of copper this year in place of 23,000,000 as last year. Hereafter only the Bonanza ore, which is so rich that it is always bagged for shipment, is to be handled on the passenger steamers, and freighters are to take the ore at La Touche. At the latter place new ore-bins have been built and loading is now done by means of a belt-conveyor, 100 tons per hour being placed on the steamer. At Valdez several small plants are being erected and at Seward a number of properties are beginning production. A number of Victoria, British Columbia, men have joined William Brewer in opening the Lost Creek mine. He has just purchased a Hendy 2-stamp mill for use during prospecting. The Kenai-Alaska Co. has ordered an 800-ft. aerial tram from the Trenton Iron Works and expects to have it in

operation by August 1. The Kenai Dredging Co. has ordered a dredge for delivery this season on the Kenai river where the Rochford dredge, a new type which digs toward instead of away from the boat, is now at work. At Iditarod the Guggenheims have shipped in a dredge from Dawson and are preparing for active work, and at Nome five new machines are reported as ordered for delivery this year. Charles Janin is examining the Pioneer mine there for London and Paris clients, and Corey Brayton has resigned from the Natomas Consolidated service to take charge of dredges on Solomon river. The volcanic outbursts in Southwestern Alaska have been spectacular, but have done comparatively little harm and a busy season is in full swing, from Kechikan to Kotzebue.

KALGOORLIE.

Whim Well copper mine, situated 11 miles from Balla Balla on the northwest coast, will shortly start treating 200 tons of ore daily with its Murex magnetic plant, and it is anticipated that a profit of £60,000 per annum will be earned. The company has already shipped some 25,000 tons of picked ore for a return of £240,000, and has 50,000 tons of 7% ore on the dump. Above water-level, at 130 ft., it is estimated that there are reserves of 1,000,000 tons of 6% copper ore. So long ago as 1895 H. P. Woodward, then Government Geologist, wrote: "It is hardly right to call it a mine, for no mining will require to be done for years, even if it be worked on a large scale, for there is a hill of copper ore that only requires quarrying." From 1891 to 1893, 724 tons of ore was shipped from the mine at a loss, and it was then taken over by the mortgagees, the Bank of New Zealand. A company was registered in London to take it over in 1900, but nothing was done till eight years later, when it was nearly universally condemned in the Press by writers who knew nothing about it. Its future is now assured, if development is pushed ahead instead of dividends being paid up to the hilt, as has so far been the case. To enable this to be done the capital has been increased four times in four years.

Refractory Ores.—The absorption of the Transvaal at Southern Cross by the Mountain Queen, only 12 miles distant, is a good move. The increased capital of £200,000 in 10s. shares should not be an undue burden. The Transvaal is a similar proposition to the Lancefield, and the ore is similarly heavily impregnated with arsenical pyrite. The lode is 12 to 16 ft. wide against Lancefield's 25 to 28 ft.,

but the ore assays 44s. against Lancefield's 32s. The substitution by the Lancefield of the 40-head mill by Krupp mills and roasting was a mistake, according to the present manager, Mr. Hope Nicholson, who says that wet crushing and roasting of the concentrate would effect a saving of £50,000 per annum in firewood consumption and make all the difference between profit and loss. Probably this treatment will be tried on the Lancefield, and, if successful, of which there is little doubt, will be adopted on the Transvaal.

North Kalgurli.—Since 1907 the North Kalgurli has been exclusively worked by tributers, who have paid royalties of £18,400 on the gross assay-value, namely, £120,450, of the 62,100 tons treated. This works out at 15'29%, but as the real extraction is, at most, 85% of the gross value, the real percentage is nearer 18%. Three months ago tributers started cross-cutting from the end of a 400-ft. cross-cut at the 870-ft. level of Brookman's shaft, and, after cross-cutting 40 ft., and passing through two orebodies, assaying 10 dwt. and 5 dwt. respectively, they struck 24 in. of ore assaying 5 oz. The tribute has only six months tenure from the date of the first crushing, so that, unless the men can afford to hang up their crushing for some months, their lease of the tribute will only last six months.

A Subsidy.—The Government is being asked to subsidize Tindals mine, Coolgardie, to test further the numerous parallel acid dikes on the property, only one of which has so far been tried, and that one to a depth of 400 ft. only. Mr. Towington Blatchford, the present Government Geologist, was recently commissioned to report on the Coolgardie field, and reported that the acid dikes in the Tindal valley held out a greater hope of persistence than such quartz veins as Bayley's. On the strength of this Mr. Halkett Dawson, Melbourne, chairman of the company, has just paid a visit to the locality, and states that the shareholders will put up another £24,000, if the Government will give its moral support by subsidizing the company to the extent of £1 for £1, the loan to be repaid should the venture prove a success. The company has already spent £220,000 on the venture, including £150,000, proceeds of gold won, and £72,000 subscribed by shareholders. It is practically certain that the scheme will be carried through.

The Associated Northern during July should start trial crushings on its Victorious mine at Ora Banda. The plant is nearing completion, and, as water has been cut in a

cross-cut at a depth of 365 ft., estimated at 40,000 gal. per day, there will be no need to wait for the completion of the Government scheme. The plant is entirely automatic, and capable of treating 400 tons per day, and, as there is assured 200,000 tons of ore having an extractable value of 22s. 6d. per ton, capable of being treated at a cost of 10s. per ton, the resultant profit should be £125,000. The total cost of the mine, with equipment and development, comes to £50,000, so that the company appears to be on velvet. The manager, Mr. Martin, is a practical miner who has risen from the ranks by sheer force of character and ability.

the last monthly progress report is the improvement in the 355-fm. level west of Fortescue's shaft, which at the date of the report was worth 88 lb. black tin per ton. The bottom levels generally seem to be opening up satisfactorily and good blocks of stoping ground are being prepared. The sinking of the main (Fortescue's) shaft is making better progress and is now 18 fm. below the 355-fm. level.

Shaft - Sinking and Income - Tax.

Francis Oats, the chairman of Basset Mines, Limited, in his speech to the shareholders a month or two since, referred to the fact that an attempt had been made by the Inland Revenue authorities to "get them to pay income-



MARRIOTT'S SHAFT, BASSET MINE.

Since cutting the sulpho-telluride ore-shoot in No. 4 lode at 2480 ft., from Great Boulder's Edwards shaft, the Golden Horse-Shoe management has driven 15 ft. south, where the lode was 36 in. wide, and worth £63 per ton. Since then, a cross-cut to the Horse-Shoe main shaft 200 ft. west, has been made.

CAMBORNE.

Grenville United.—According to the Ticketings, it will probably be found that this company, for the half-year ended June 30, sold close on 50 tons of black tin more than in the previous six months, when the accounts showed a profit of £10,734. This increase has not been due to a larger output but to an improvement in the grade of ore handled of nearly 4 lb. per ton. A favourable feature of

tax on the money that was spent on the sinking of Marriott's shaft." He further stated that the company had won their case before the Commissioners at Camborne, but that an appeal had been lodged in the High Court, where as far as he could gather, the company would also win. The matter is one of considerable importance to mining companies generally, who are working properties in this country, and the appeal in the High Court will be watched with interest. I am afraid Mr. Oats is optimistic in anticipating that the decision will be in his company's favour; all past decisions on the same question have been to class expenditure on sinking shafts as capital expenditure, whether being sunk in ore or not.

Reform of the Income Tax Acts is a matter

that of late months has received the serious consideration of many influential bodies in the world of commerce, notably the London Chamber of Commerce. That body has recommended that a deduction from the gross profit should be allowed to be made for depreciation on shaft-sinking and developments undertaken to gain access to orebodies, and also on wasting assets such as minerals. Every mining man must recognize the necessity for writing down the cost of shafts, either by means of an annual charge or as a regular unit in the working cost, and if only the bodies representing the mining industries of this country would combine to press this home on the Inland Revenue authorities there might be a chance of getting the matter favourably considered. In Cornwall, now that the Chamber of Mines is defunct, there is no body to undertake this work, and mining companies here seem quite content to make no effort to either resist new burdens or get old ones removed.

Wheal Kitty & Penhalls—This company is the first to publish its half-yearly report and accounts for the six months ended June 30 last. The profit earned was £702, making, with £820 brought forward from last account, a sum of £1522 available. From this, £376 is allocated for depreciation on buildings and machinery, and it is proposed to pay a dividend at the rate of 10% on the preference shares, which will absorb £299, leaving £848 to be carried forward. The yield per ton has jumped from 19'9 lb. last half-year, to 28'5 this six months, but this is obviously largely due to the better selection underground, and not so much to an improvement in the content, for the tonnage milled has dropped from 8384 to 6090 tons, although no doubt about 1100 tons of this reduction is accounted for by the stoppage of the mill through the coal strike in April last. As will be seen below, the working cost, largely as a result of the better selection, has gone up 6s. 3d. per ton, and the royalties have risen 1s. 2d. per ton (heavier royalties being paid when profits are made) so that altogether the working cost is up 7s. 6d. per ton.

Sara's shaft is now 750 ft. deep, and a station is being cut at a depth of 720 feet, in order that the lode intersected at that depth may be developed. Although, according to the official post-card issued, the management were not at first disposed to admit this was the faulted section of the main Kitty lode, for which the shaft was principally sunk, because probably it was poor and pinched, yet apparently they have now changed their opinion,

and propose to open it up forthwith. It may well be that on development, this lode will open out and improve in content, for the Kitty lode was always a patchy one and it is quite possible that the shaft intersected it in one of the poor parts. The ground around Sara's shaft is clearly very disturbed, so shareholders must not be discouraged.

London and West-Country Chamber of Mines.—The demise of this organization is announced. It was founded by J. H. Collins in 1901, so it has had an existence of a little over ten years. It never received the support it deserved, nor have the usual functions of a Chamber of Mines been carried on for some years past, owing to the lack of interest shown both by its own members and the managers of the mines. It however carried on one useful work, the publication of statistics and reliable information about the mines, and the little brochures containing this information will be much missed by all who have to write on Cornish mining matters. Harold E. Fern, who has edited these 'Records' for the past six years, and has been chiefly responsible for them, expresses his willingness to co-operate in any attempt to found a new Chamber of Mines, and certainly, in view of the renewed interest being taken in the mines of the County, such an institution, if run on right lines and adequately supported financially, could be of great service. In the past there has been too frequently an attitude of aloofness and a desire to act independently on the part of the managers of our mines: other mining districts appreciate the value of a Chamber of Mines to represent the many interests concerned, so why not Cornwall?

South Crofty.—The comparative figures given below show that the grade of ore milled has slightly fallen, although possibly this may be partly due to the fact that the higher price ruling for tin enables the management to profitably treat ore of a lower content. When it is remembered that the working cost last year was 21s. 9d., it will be seen that even with the ore of the grade of the past six months, the profit per ton figures at about £13,000 or say 8s. per ton, which is higher than any other mine working in Cornwall, and will easily admit of quarterly dividends of 1s. per share, which each absorb £2500, and a substantial bonus at the end of the year, should the prices of the minerals recovered show no violent fall.

In South Crofty, we have an excellent example of the possibilities of Cornish mines, when not over-capitalized, and provided with

Six months ended	Tonnage Milled	Tin and Wolfram Recovered			Arsenic and Sundries Est. Value	Total Value		Development Footage	
		Tons	Estimated Value	Per Ton Milled		£	Per Ton Milled	Feet	Ratio to Ore Milled
			£	lb.	£		s. d.		
June 30, 1911	31,205	413	46,315	29'6	402'4	50,344	32 3	2448	1 in 13
Dec. 31, 1911	32,678	414	44,823	28'3	5011	49,834	30 6	2393	1 in 14
June 30, 1912	32,979	379	44,219	25'7	4753	48,972	29 8	2143	1 in 15

ample working capital, managed by technical men, and worked for the benefit of the shareholders.

Restrouguet Creek.—It has recently been announced that another attempt is to be made to work the alluvial ground on the bed of this estuary of the river Fal, and into which falls the river system of the Carnon valley. John Taylor & Sons, in 1872, sank a shaft 82 feet vertical in the bank and drove from the bottom under the bed to the centre of the creek, where for ventilation an air-shaft of iron pipes was put up to surface and above high-water mark. However, this method of working the deposit did not prove satisfactory and was abandoned. C. G. Lush & Son have now acquired the right to work the property and they propose to do so by means of a bucket dredge. It is reported that recent borings have disclosed, at a depth of 63 feet from the bed of the creek, over 6 feet of alluvial wash, assaying 18 lb. black tin per cubic yard.

St. Ives Consolidated Mines.—The report recently issued by the directors shows that during the 32 weeks ended May 25 last, the production of black tin from the Giew section was 103½ tons, realizing £10,864. As the battery consists of 20 Californian stamps and these, according to the report, were working continuously, it may be assumed that not less than 400 tons of ore per week was milled, or, for the 32 weeks, 12,800 tons, which would give a recovery of about 18 lb. per ton. The manager estimated in October last that the reserves would average slightly over 20 lb. of black tin per ton, so that he was not far short of the mark.

There has been a distinct improvement of late, but what is wanted is one of the carbonas for which this district is famous, for evidently the grade of ore milled must be considerably improved before profits can be made.

The annual reports and accounts to December 31 last are now overdue. Why it should take a company working a property situated in England seven months to prepare and pub-

lish its accounts is one of the puzzles that we in Cornwall have never yet solved. Two months is usually sufficient for Dolcoath and the other large mines.

MELBOURNE.

The Iron Industry.—Matters in connection with the establishment of iron works in Australia by the Broken Hill Proprietary company are maturing fast. Six or eight months back G. D. Delprat, general manager for the company, left for England. His mission was described vaguely as being in the "interests of the business of the company," but it was generally surmised by people who follow the proceedings of the Proprietary company that Mr. Delprat's mission was to report to his board regarding the establishment of works for turning to account the iron ore deposit owned by the company in South Australia. This deposit consists of two hummocks of different areas, known as the Iron Monarch and the Iron Knob. A large proportion of the ore is hematite of high grade, much superior to that from the Mesabi range in the United States. The deposits are of great extent and are computed to contain fully 100,000,000 tons of ore so far as proved. The ore has hitherto been used as a flux in connection with the lead smelting business of the company. To fortify the directors in any action that they may contemplate, Mr. Delprat arranged with David Baker, well-known in the United States, and understood to be consulting engineer to the Steel Trust, to visit Australia with the object of reporting on the deposit, as well as outlining the general scheme of work in the event of his report being favourable.

The general tenor of Mr. Baker's report has not been made public, but it can be said that he is more than satisfied with the value of the deposit. Then came the question of treatment and of the cost of labour. After ascertaining the grade of the ore, Mr. Baker seems to have satisfied the board that he was confident that the ore could be treated easily, that fluxes

were accessible, and, that the cost of labour, though high, would allow a satisfactory margin of profit to the company. It is one of the best signs of the Broken Hill Proprietary company's management that it calls to its aid men of the highest talent whenever it decides to make any departure in method or in business enterprises. This was done when the company took in hand the treatment of the zinc concentrate obtained from the tailing dumps at its mine at Broken Hill. Mr. Arnemann, a well known Belgian expert, was secured, and under his guidance the company defeated its critics by first of all finding suitable clays for the retorts and next by treating the zinc with Australian labour at a cost that is quite as low as in any part of Europe. The recovery of zinc also was more than satisfactory when the newness of the work and the need of training men were taken into account.

One of the points that the Board has now had to consider is whether they would take the iron ore to the coal or bring the coal to the ore. It now appears that the company has decided to go to Newcastle, New South Wales, where it will be in touch with some of the finest deposits of coal in any part of the world. The aspiration of the Labour Party has been to nationalize the iron industry, but the Proprietary company is forestalling the party in that respect. It does not ask—at the moment, at any rate—for any duty on iron. What it does suggest to the Labour Government of New South Wales, however, is that some facilities shall be given it in the way of deepening the harbour approaches to the water frontage at Newcastle, and it is satisfactory to know that the Government is inclined to lend a helping hand to the industry.

Obviously the company has not a reserve sufficiently large to cover the expenditure required for such work, and therefore an appeal will have to be made to the public for capital. This will take the form of an issue of debentures, as the money that will have to be expended will run well into £1,000,000 sterling. Before this letter reaches London no doubt the ideas of the directors will have been crystallized and their programme defined.

The company starts well in every respect. Its credit is good, so that it ought to have no difficulty in securing any capital necessary. It already has a splendid staff, and it will certainly avail itself of the leading practice in the metallurgical line that modern science can suggest. The company will no doubt engage in the manufacture of steel rails,

because with the millions that are being spent annually in the construction of railways to open up this great continent, it will possess a fine market for the product. As it is able to recover zinc from its Broken Hill tailing and perhaps from its slags at Port Pirie, it may also engage in the enterprise of galvanizing iron. There are other side-lines in connection with the manufacture of iron and steel from the ore which need not be outlined, but the proposed venture, if decided upon by the board, will mark a decided advance in our manufactures. There have been several attempts to manufacture iron in a small way, but so far labour troubles and lack of capital have told against their success. The Proprietary company will start under altogether different auspices, and with a technical skill at this end that has not been available for any other similar enterprise of the kind yet begun in Australia.

High Metal Prices.—Australians are pleased with the course of the metal market, especially as the drought has left some trace of its existence despite recent rain. The districts that are most affected by the high level of prices are the Barrier Range and North Queensland, because those two centres now lead the way in silver, lead, and zinc, and in copper respectively. It is satisfactory to know, however, that we are keeping our heads despite the inducement to go booming. As far back as 1902 we began to lose some of our holding in the leading stocks of the Barrier Range, especially in North Broken Hill, and to some extent in South Broken Hill and Block 10. The zinc problem was not then clearly solved by the flotation process, and on the subsequent jump in prices occasioned partly by shrewd people recognizing ahead of shareholders what the process meant to the Barrier and by the advance in metals in 1907, further blocks of shares were lost to Australia. It can now be said, therefore, that about two-thirds of the leading Barrier interests are held abroad. The mine to which Australians have clung most persistently has been the South, and to a less extent the British; nearly all the North, Sulphide Corporation, Proprietary, and over half of the Block 10 issues are controlled in London. Adelaide is the recognized market for Barrier scrip, and there large transactions have taken place of late in Souths, Norths, and British, as strong feeling exists that the metal markets are going to improve still further, and that this movement will carry up the price of stocks. Whether this be right or not time will show.

At Broken Hill, the leading development reported of late has been the strike of ore in a cross-cut put out from the Central mine on the Block 10 boundary. This ore would be of importance to the Block 10 company if it continued back into that claim. This has to be proved, and on that the fortunes of this mine to a very considerable extent depend. O. B. Ward, who recently took charge of the property, furnished the directors a little time since with an estimate of the ore in reserve. He cut down V. F. Stanley Low's estimate substantially, giving the total ore proved as under 300,000 tons. The grade of this ore

lengthen the life of the Zinc Corporation substantially.

At the British mine, developments have been in the nature of clearing up the doubt that was felt as to the accuracy of the estimate of 2,000,000 tons ore given by the general manager, W. H. Woodhead. This estimate was challenged by an ex-surveyor, Mr. Thomas, who in turn had his figures and deductions controverted by Mr. G. C. Klug, general manager for Bewick, Moreing & Co., who was asked to inspect the mine on behalf of the board. Recently the management was enabled, owing to the shaft having been carried



THE WAIOTAH MINE, THAMES DISTRICT.

is low, and it is of the utmost importance, therefore, to the company that high metal prices shall continue. It has been said that Mr. Ward has been over-conservative, but he knows his work, and the generally recognized position here has always been that the Block 10 company was in not too assured a position. Then in the South Blocks mine, the developments at depth both at the lead and the zinc lodes are highly satisfactory. It is gratifying to be able to say this, because the amalgamation of the Zinc Corporation and the South Blocks was criticized in these columns as being too favourable to the latter company. On the developments up to the time that the criticism was penned this appeared to be the case, but it is now fair to the company to say that the widening of the orebody in the South Blocks mine at the bottom level will help to

down to No. 10 level on Thompson's shoot, to test the orebody by the diamond-drill at greater depth. Boring was entirely satisfactory, for a large amount of high grade ore was passed through, and in addition a considerable length of average grade material was drilled. Driving is now progressing with the object of contouring this formation. People here await the final programme of the board. Until that is disclosed it appears hopeless to long for any hardening in the shares of the company. Here the feeling is that it would be far better to adopt the Australian practice and provide any money wanted for equipment out of working profits, but that does not suit the London book.

The Gold Mining industry in Australia is awaiting a revival. In Western Australia no new centres are being developed, but investors

are paying attention to low grade properties which require capital to turn to account. Many of these were tested at the boom time, but the reports were unfavourable because of the cost involved in handling them. There is a firm conviction that at depth the Kalgoorlie lodes are not holding their own so well as was expected, and this conviction has been upheld by the mining statistics of the State for 1911, which show a fairly solid reduction in the grade of the ore treated. In Queensland the same tale of declining yield has to be repeated, and Victoria, if it were not for the revival in Bendigo on the side lines, would have to show a poorer record than of old. It would appear, however, as if the collapse of deep mining is going to divert capital to the side lines. Should promising discoveries continue, then the outlook for Bendigo is infinitely superior to what it was a year back. What is cheering is that some of the deep lead mining is improving, especially at Ararat and adjoining the big Avoca system. There the Loddon deep leads and the Carter's leases are being worked by London companies with returns which seemed to indicate that these shares may restore some of the credit in British eyes which once attached to deep lead mining in Victoria.

AUCKLAND.

Depression.—The present position of the industry in the two islands may be termed unsatisfactory. At Coromandel and the Thames, on the Hauraki peninsula, little is doing. At Waihi, a difference of opinion between the engine-drivers' and miners' unions has resulted in the shutting-down of the Waihi and Grand Junction mines. At Karangahake, the Crown and Talisman mines are being operated profitably. In the South Island, the miners at Reefton are out on strike because they consider one man not enough to handle small machine-drills. The miners in the coal mines on the West Coast also appear very restless, and in anticipation of trouble, everybody is stocking coal in large quantities.

Thames.—In this goldfield the May Queen and Waiotahi do not offer much encouragement at present. The Thames-Hauraki pump at the Queen of Beauty shaft, is pumping 600 gallons per minute, while the cross-cut from the 100-ft. level is out 2,100 ft. toward the Waiotahi ground. Apart from the drainage question, several local people are not too sanguine about the results. The Moanataieri fault seems to have affected the lodes in depth unfavourably.

Waihi.—The Komata Reefs is still pegging away on 40s. ore in a small way. At Waihi

and Waikino, about 2000 men are out of work, and a district of some 6000 people is being depopulated. A stupid business is this strike and it is hard to see when it will end. Not a pump or wheel of any kind is at work. The water in the mines is not rising fast, and no damage is expected to result. The unions have tried to draw the companies into the turmoil, but they rightly refuse to get mixed up, although they met the union people. The men are receiving small amounts of strike pay from various other unions, but the latter are not keen on forwarding much, in fact, several question the rights of the dispute. From personal observation, I am forced to conclude that fully 80% of the men are against the strike, yet they will not declare themselves openly. Advantage is being taken of the stoppage to effect many repairs and renewals in the various mills. The last annual report of the Waihi company states that the reserves amount to 828,012 tons of ore, besides 706,814 tons in arches and pillars. The position is not equal to the last report. At Karangahake, I found the Crown improving slightly, and the Talisman treating fairly high-grade ore. The strike has not affected this locality. At Paeroa, near the junction of the Waihou and Ohinemuri rivers, and 15 miles from Waihi, the Paeroa Gold Extraction Co. has a splendidly equipped plant at work treating the old tailing from the bed of the latter river. The method is to dredge the river, transport the tailing in barges to the plant, which consists of elevating the sand to vanners to get rid of river rubbish, grinding the clean sand in 20 tube-mills, thickening the pulp, agitating in tall vats, and filtering in a vacuum-plant of new design. The mill can treat 500 tons daily of clean sand at a cost of 3s. 6d. to 4s. per ton, the gold and silver contents being some 8s. per ton. [We publish an article on this enterprise elsewhere in this issue. EDITOR.]

Reefton.—Regarding the trouble at Reefton, it may be described as being as foolish as that at Waihi. In both places the men make high wages. In Western Australia a single man handles a baby or popper drill, as at Waihi. Evidence for the Reefton dispute has been taken at Waihi already. On July 11, the Reefton Miners' Union is to apply for the forfeiture of the two claims of the Consolidated Goldfields and Blackwater mines for non-working, and against the same companies when applying for protection, during the strike. The unrest here has also upset the coal miners, but it does not take much to make coal miners go out on strike anywhere.

BRITISH COLUMBIAN MINERALS

By E. JACOBS.

THE Annual Report of the Minister of Mines for British Columbia for 1911 was issued on July 3. As compared with 1910, the mineral production for 1911 shows a net decrease in value of \$2,877,994, and in quantities of the several minerals as indicated in the following table :

Mineral.	Production in 1911	Quantity.	Value.	Changes.	Quantity.	Value.
Gold, placer.....	—	\$	426,000 —	—	\$	114,000
Gold, lode..... Oz.	228,617		4,725,513 —	39,084 oz.		807,867
Total gold.....		\$	5,151,513 —		\$	921,867
Silver..... Oz.	1,892,364		958,293 —	557,877 oz.		286,723
Lead..... Lb.	26,872,397		1,069,521 —	7,786,349 lb.		316,829
Copper..... Lb.	36,927,656		4,571,644 —	1,316,278 lb.		299,868
Zinc..... Lb.	2,634,544		129,092 —	1,549,648 lb.		63,381
Total metallic.....		\$	11,880,063 —			\$1,888,668
Coal..... Tons	2240 lb. 2,193,062		7,675,717 —	606,984 tons		2,124,444
Coke..... do. do.	66,005		396,030	152,024 tons		912,144
Miscellaneous products.....			—	gross.....		\$4,925,256
			3,547,262 +			2,047,262
Total value of production.....		\$23,499,072		Net decrease		\$2,877,994

The comment of the Provincial Mineralogist on the situation is as follows :

"Without explanation, an improper significance might be attached to the year's diminished production. For a period of eight months the coal-mines of East Kootenay district were completely tied up and made no production, owing to a labour dispute incident to the fixing of the 'agreement' as to wages for the next few years. The loss of production of coal and coke alone directly attributable to this shut-down amounted to \$3,324,342, while there was almost as large an indirect loss occasioned by the stoppage of the coal and coke supply of the mines and smelters of Boundary district. For the months that operations were carried on at full force the output was more than up to the standard of 1910, and but for the labour troubles it is probable that, instead of a decreased production, the year 1911 would have shown an increase. The tonnage of ore mined in the lode mines of the province during 1911 was 1,770,755 tons, a decrease from the preceding year of 445,673 tons, or 20 per cent. This total tonnage was produced

by the various districts in the following proportions : Boundary, 70'25%; Trail Creek (Rossland), 14'36%; Fort Steele (East Kootenay), 1'74%; Coast district, 8'09%; all other districts, 5'56%. The number of mines from which shipments were made was 80, and of these only 45 shipped more than 100 tons each

during the year, while but 30 shipped in excess of 1000 tons each. Of these latter, six were in Nelson mining division, nine in Boundary district, five in Slovan district, four in the Coast district, three in Trail Creek division, two in Fort Steele division, and one in Kamloops division."

By districts, production was as under :

District.	Value.	Changes.
Cariboo.....	\$ 180,000 —	\$ 59,000
Cassiar.....	293,442 +	9,635
East Kootenay....	2,475,056 —	3,646,776
West Kootenay...	4,343,912 —	744,274
Boundary.....	5,621,109 —	1,377,410
Lillooet.....	6,467 —	3,365
Coast... ..	10,579,086 +	2,943,196
Total.....	\$23,499,072 —	\$2,877,994

The greatest loss in production was in East Kootenay, in which district there was not only a largely decreased production of coal and coke, but as well a considerable decrease in lead, owing to the exhaustion of the known orebodies of the St. Eugene mine, heretofore the largest lead-producing mine in Canada.

In the Coast district, the increase was chiefly in copper and building materials, and to a small extent in coal. In Boundary district the decrease was caused by the strike of the Crow's Nest miners cutting off the supply of coke for copper-smelting purposes, for about five months, at the Granby smelter, and the consequent considerable reduction in quantity of metals produced.

The gross output of coal mined was 2,297,718 tons (of 2240 lb.) Deducting 104,656 tons made into 66,005 tons of coke, there remained a net output of coal of 2,193,062 tons.

Reverting to production of metals, of the total of \$426,000 of placer gold, \$225,000 was from Atlin division of Cassiar, and \$170,000 from Cariboo and Quesnel divisions of Cariboo district.

Rossland mines contributed nearly \$2,412,000 of the lode-gold, Boundary (including Hedley, Similkameen) mines \$1,814,000, those of Nelson division \$365,000, and of the Coast district \$120,000. Other parts of the province produced but little lode gold.

Slocan district mines, including Ainsworth, produced silver to the value of \$441,000, East Kootenay \$167,000, Boundary \$166,000, the Coast \$51,000, Rossland \$45,000, Nelson \$39,000, Lardeau \$34,000, and smaller amounts from Portland canal and elsewhere.

Of the lead production, East Kootenay produced \$683,000, Slocan and Ainsworth \$278,000, Nelson \$77,000, Lardeau \$20,000, and nearly \$10,000 from Portland canal.

The chief output of copper was from Boundary with a reduction of \$2,764,000; Coast mines came next with \$1,362,000, and then Rossland \$425,000.

The production of zinc, valued at \$129,000, was chiefly from the Van-Roi mine, while the Hewitt mine, also near Silverton, Slocan lake, produced a much smaller quantity.

The total number of men employed at the mines of the provinces in 1911 was 10,467—3594 at metalliferous and 6873 at coal mines.

Reports of more than ordinary interest included are on the Granby Company's Hidden Creek mines, Britannia mine, mineral claims in Hazelton district of Skeena river country, Slocan mining division, Groundenog coal basin and other coal areas in Skeena country, the French process of separation of zinc and lead, of an investigation into the reported occurrence of platinum near Nelson (which investigation was resultless so far as finding platinum is concerned), on demonstration of smelting copper ore in an oil-fired furnace, on the limestone deposits of the Coast.

Gold Coast in 1911.

The official report on the mining industry of the Gold Coast for 1911 states that the value of the gold produced during the year was £1,079,024, being an increase of £298,626 as compared with 1910, and is the largest production since the year 1908. In the Gold Coast Colony the increase amounted to £171,048, and in Ashanti the increase was £127,578. The increase in the Gold Coast Colony was due to the Prestea Block A and the Broomassie mines re-starting to produce gold, and the increase in Ashanti was due to the enlarged production by the Ashanti Goldfields Corporation. The production was 253,977 oz., of which 238,571 oz. was obtained by mining, and 15,406 obtained by dredging operations in the Ankobra, Fura, and Offin rivers. From the conglomerate mines 91,802 short tons was crushed and treated, producing 44,233 oz., being an extraction of 9'64 dwt. per ton crushed; while from the quartz mines 359,990 tons was treated producing 194,289 oz., giving an extraction of 10'79 dwt. per ton treated. By sluicing 49'4 oz. was obtained. The various dredging companies treated 2,545,173 cu. yd. of alluvium with a production of 15,405 oz., being an extraction of 2'9 grains per cubic yard treated. The average daily amount of labour employed by the mining and dredging companies throughout the year was 19,153, as compared with 19,138 employed in 1910. Throughout the year there was no apparent shortage of labour in the mining districts, but toward the end of the year several mining companies started to introduce labour from other colonies to meet the anticipated increased requirements for the year 1912.

YEARLY OUTPUT OF GOLD FROM 1892 TO 1911.

Year	Oz.	Value
1892	23,259'410	98,806
1893	18,620'290	79,099
1894	18,078'150	76,796
1895	21,538'840	91,497
1896	20,288'600	86,186
1897	19,961'630	84,797
1898	15,027'777	63,838
1899	12,076'270	51,300
1900	8,947'050	38,007
1901	5,222'920	22,187
1902	22,806'050	96,880
1903	59,978'810	254,790
1904	89,096'186	378,480
1905	153,912'600	653,820
1906	210,349'435	892,291
1907	273,898'178	1,163,516
1908	281,257'206	1,194,743
1909	230,494'317	979,073
1910	183,691'379	780,398
1911	253,977'204	1,079,023

A TAILING PLANT

By CHARLES A. BANKS.

IN September 1909 I was engaged by the Waihi-Paeroa Gold Extraction Co., of Auckland, New Zealand, to design and erect a plant capable of grinding and treating by cyanidation, for gold and silver, 500 tons of quartz sand per day. The plant has now been successfully running for 5 months; the following is a description of it and some of the troubles that had to be overcome.

The sand for treatment has accumulated during the last 20 years in the lower reaches of the Ohinemuri river, and is a natural con-

26 ft. below the water-level, into four 70-ton barges, which are filled in turn and towed by two oil-launches to the unloading wharf in front of the plant. The machinery on the dredges consists of a 30-hp. oil-engine driving a centrifugal pump and air-compressor for delivering water and air to the bottom of the 9-in. diam. telescopic air-lift, which loosens the sand and raises it above the water-level, whence it is lifted by a 20-in. bucket belt-elevator and distributed to the barges.

On arrival at the wharf the sand is lifted



DEPOSIT OF MILL TAILING ON THE BANKS OF THE OHINEMURI RIVER.

centrate of the various tailings dumped into the river from the mills in the Karangahake and Waihi districts. The present company experimented for several years, treating these various tailings before deciding to erect a plant that was to cost about £70,000.

The flow-sheet planned by the company prior to 1909 is as shown herewith; it consists mainly of grinding the cleaned sand in cyanide solution and then agitating and vacuum-filtering it. (See Fig. 1).

To remove the sand a dredging plant is employed. This carries an air-lift capable of lifting 100 tons of sand per hour from as deep as

out of the barges by means of a 20-in. bucket swinging belt-elevator, with 40-ft. centres, placed on the wharf directly in front of the plant. This elevator delivers the sand through a rotary screen for separating rubbish, into a ferro-concrete storage tank of sufficient capacity to hold 3000 tons of sand under water. This large hopper was built to allow of a week's stop in the river plant without affecting the output of the grinding machinery.

The sand for treatment is lifted out of the storage-tank at the rate of 500 tons in 24 hours by a small air-lift, and gravitates to a 12-in. bucket belt-elevator, which delivers it to ten

6 ft. vanners. The vanners separate the quartz sand from the lighter and worthless river-sand and charcoal present; the latter, derived from ashes that have been thrown into the river from the furnaces of the various batteries, would seriously affect the cyanide operations were it not removed.

The charcoal and river-sand escape at the foot of the vanners, while the cleaned quartz sand passes over the head of the machine in a layer about $\frac{1}{2}$ in. deep, which is flushed by a spray of weak cyanide solution. The mixture is then lifted by a 12-in. bucket belt-elevator and discharged into a 100-ton hopper, whence the cyanide solution returns to the vanners and the clean sand is lifted by an air-lift.

The sand from this air-lift is delivered into a mechanical distributing pan and is evenly distributed through launders to the 20 tube-mills. The sand from the tubes gravitates to the elevator wheels, which lift it 35 ft. above the floor of the building and discharge it into classifiers where the -200 mesh material overflows; the coarser material, discharged through the bottom of the boxes, delivers into the distributing pan and is returned to the tube-mills. Although only 500 tons of sand per day is treated, the tubes have approximately 3500 tons of sand passed through them in 24 hours. The tube-mills are 16 ft. long by 4 ft. diam. inside the cast-iron ribbed liners and carry a flint load of 4 tons. They revolve at 27 revolutions per minute, taking 27 hp., and they grind 25 tons of sand through a 200-mesh screen in 24 hours.

The tube-mills (see plan) are placed on three sides of, and very close to, the elevator wheels. By this arrangement the longest run of pulp from tube-mill to elevator-wheel is only 70 ft. This arrangement with its many advantages is rendered feasible by my new method of driving, as applied on 16 of the mills shown in the plan. The tube-mills are arranged in four rows with a main shaft running between each pair of rows. Each shaft has 4 cast-steel pinions at intervals of 28 ft. Each pinion is keyed to a 100-hp. Heywood & Bridge friction clutch sleeve, actuated by a screw striking-gear, and may be engaged or disengaged quickly and satisfactorily. This pinion engages two tube-mill spur-wheels; and so, by the simple operation of half-a-dozen turns of the hand-wheel, two mills are started or stopped. The tube-mills are on sole plates with adjusting screws and may be run back out of gear in case it is found necessary to hang-up one mill and work the other. This drive I have found absolutely satisfactory and

far ahead of tight-and-loose pulleys, over which it has the following advantages: (1) smaller building; (2) mills closer to elevators, and therefore less height to elevate the pulp; (3) considerable saving in capital expenditure and running cost; (4) no belts; (5) main shafts on ground instead of on high trestles as is usual; (6) a balance pinion, the pinion practically floating as it works; the bearings therefore receive very little wear.

The only disadvantage (and this is small) is that a breakage of teeth on one spur-wheel may cause damage to the other wheel.

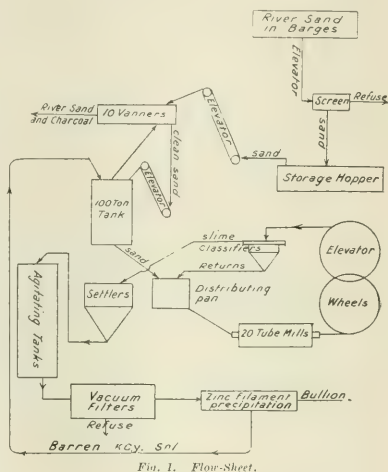


Fig. 1. Flow-Sheet.

The main shafts, of 6 in. diam. throughout, revolve at 133 rev. per min. and are fitted with ring bearings.

The elevator-wheels are massive in design; there are two double wheels each 24 ft. diam., one above the other.

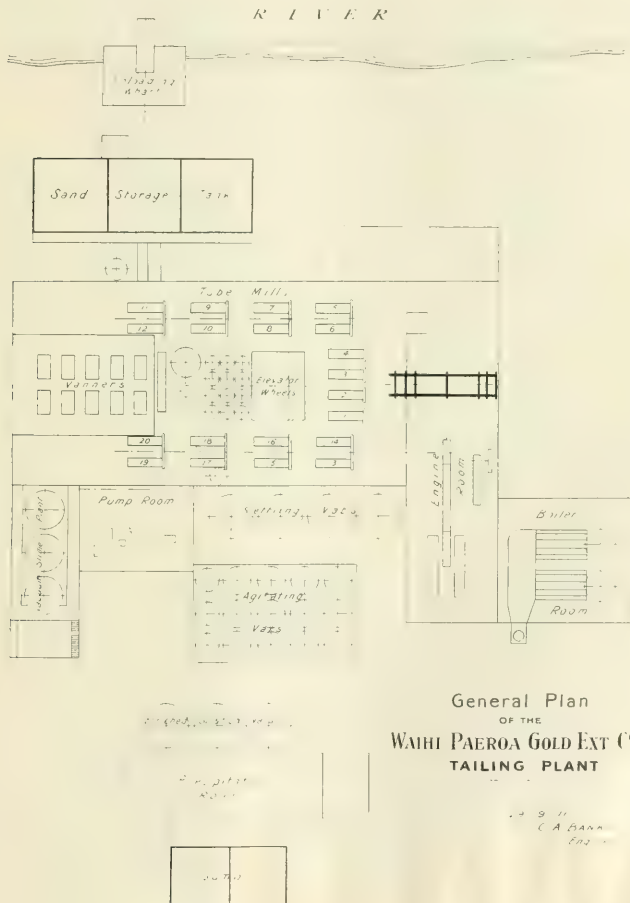
The buckets are 24 in. wide, of $\frac{1}{2}$ -in. plate, and are of sufficient capacity to lift the 3500 tons of sand and 5000 tons of solution from the 20 mills with ease in 24 hours.

The bottom wheel, in place of the usual centre shaft, has a 4 ft. diam. $\frac{3}{8}$ in. steel-plate cylinder with trunnion ends (similar to a small tube-mill). This is a satisfactory arrangement, as it does away with deflection of the shaft and obviates the use of keys for keying the spur-wheel and arm-centres. The keying of centres to a shaft is unsatisfactory where the elevator is working in a 'boot' and con-

sequently subjected to severe uneven strains. The top wheel has a 10-in. diam. mild-steel shaft; the cast-iron centres are placed close to the bearings to stop deflection, and as the wheel is not working in a boot, the putting-in

centrifugals into 15 conical-bottomed agitator-vats each 13 ft. diam. and 50 ft. deep. Here the slime is air-agitated with cyanide solution for about 48 hours.

From the agitators the slime is run into the



of the shaft with keyed-on centres is quite satisfactory.

The slime from the separating-boxes is mixed with lime and settled in 4 conical bottomed vats 20 ft. diam. and pumped out by

vats (A) of the vacuum slime-plant and is kept from settling by 4 small air-lifts. The vats (B) serve the double purpose of washing and discharging. With a vacuum of 18 inches a 1½-in. cake, amounting to 9 tons dry, is formed

in 15 minutes; the basket is transferred by a 16-ton electric crane from (A) to the vat (B), where it is washed for 18 minutes. Compressed air is then applied and the cake is blown off and deposited in the cone of the vat. A disintegrator churns the cakes at the bottom, where water is added and the slurry is run to waste. The slime-vats are made circular and four sizes of frames are used; but this is not inconvenient. One crane with 1 pulp and 2 wash-vats 20 ft. diam. and 2 filter-baskets, each of 1660 ft. area, can easily treat 500 tons in 24 hours.

The enriched solution from the baskets runs

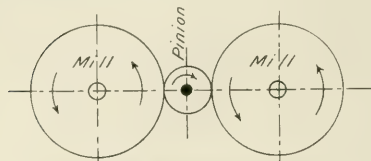


Fig. 2. Floating Pinion driving Two Tube-Mills.

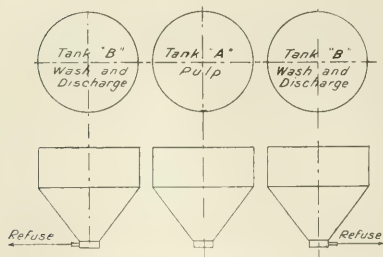


Fig. 3. Vacuum Slime-Plant.

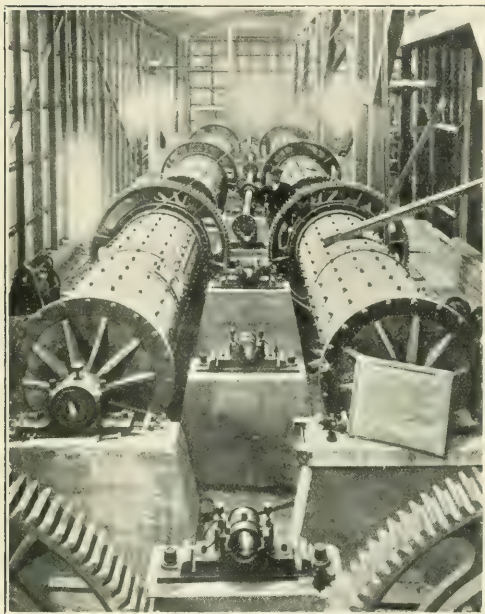
to three corrugated iron vats, 20 ft. diam. and 6 ft. deep, whence it gravitates through 24 zinc-filament precipitation-boxes to a 300-ton ferro-concrete sump, to be returned by 4-in. centrifugals to the plant.

The power is generated by two batteries of Babcock & Wilcox boilers working at 150 lb. pressure and fitted with chain-grate stokers, economizers, and superheaters. The coal is lifted by an aerial tram to two 50-ton circular wrought-iron hoppers commanding the feeders. The main engine is a 630-hp. Hick-Hargreaves Corliss cross-compound, driving with sixteen $1\frac{1}{2}$ -in. cotton ropes to the main shaft. A second engine of 180 hp. is installed for taking up the running of the air-compressors and dynamo when it is found necessary to shut-down the main engine. The 50-k.w.

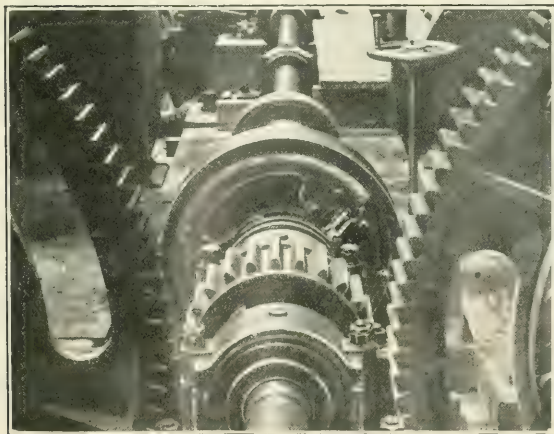
220-volt dynamo lights the plant and drives 3 motors.

The average assay-value of the tailing in the river is approximately 11s. 6d. per ton. The management is confident of getting the residue down to 2s. 6d. with a running cost not exceeding 3s. 3d. per ton. This leaves a large margin of profit, and, given a huge deposit of sand, a long and profitable life is assured.

Converters for the treatment of copper matte (we quote the *Mining and Scientific Press*) were first made of a shape similar to the bessemer converter, and the persistence of association of ideas of the two operations is so strong that reference is still made to the 'bessemerizing' of matte, though the action in the copper converter bears little resemblance to the converting of steel, beyond the fact that both are produced by blowing air through a molten mass. In the early converters the tuyeres were placed some distance above the bottom, with the idea of keeping them above the level of the copper formed in the operation. At the Copper Queen in Arizona this plan was varied by making the longer axis of the converter horizontal, placing the tuyeres in a row on the near side, and by tilting the converter the incoming air was kept above the copper. Both types proved successful, and a semi-geographical distribution of form developed; the plants in the southwest of the United States using the horizontal or Bisbee type, while in the northwest the vertical or Anaconda form was preferred. Changes in practice have eliminated some of the early considerations, and the present-day converter foreman finds it difficult to believe that the preventing of the blowing charge from getting too cold was ever a problem. At Great Falls the upright type has evolved into a converter 12 ft. in diameter and about 15 ft. high, using air at 12 lb. pressure, as compared with the 5 $\frac{1}{2}$ lb. of the early Bisbee form. The deeper column of matte and higher blast-pressure is more effective to produce rapid oxidation, while the circular cross-section gives much more effective support to the lining, and is more convenient to re-line. E. D. Peters some time since prophesied an eventual return to the upright form of converter, and the recently announced intention to adopt the Anaconda form for a new construction at Cananea, where the Bisbee type has been in use, is strong evidence of fulfilment of the prophecy.



TUBE MILLS.



METHOD OF DRIVING TUBE MILLS.

AN EXCURSION IN CORNWALL

By EDGAR RICKARD.

CORNWALL is the oldest of existing mining districts and the best known, speaking in the limited sense of the association of the name with mining traditions. Less is known of the specific details of Cornish mining and metallurgical practice than of isolated districts in distant parts of the world, and undoubtedly this lack of detailed knowledge is responsible for the universal opinion that the methods employed are essentially crude.

Representatives of the joint scientific societies of Great Britain were guests in Cornwall last month, and with unfailing hospitality were given every facility to judge how far this severe criticism is deserved. The arrangements for the tour were made with great foresight and it is not possible to conceive of an itinerary that could compress more into four days. At least two occasions each day were offered for short speeches, chiefly of the congratulatory order. Eliminating the complimentary prefaces that usually accompany remarks on such occasions, a distinct line of thought found a place in every toast. The directors, managers, and others directly concerned in the operation of mines in Cornwall recognize that the loss of tin is considerable. They seem, however, with one or two notable exceptions, satisfied that every known method for increasing the extraction has been tried and regard the present appliances as fully adequate. They believe that only a new chemical process, analogous to the cyanide process for gold, can properly solve the metallurgical problem. They, one and all, expressed the hope that out of this visit would come suggestions for the betterment of the tin industry. In this invitation lies our excuse, should we require an excuse, for frankly discussing the situation as we see it in Cornwall.

No engineer could be expected to base any correct idea of the efficiency of any particular plant on an hour's visit with an eager crowd of 80 enthusiasts receiving scraps of information well intended for the entire party, but generally only distinctly heard by two or three fortunate ones near enough to the speaker to ply him with questions. I do not intend to discuss details, as I carried away only general impressions.

At the luncheon at the Porthminster hotel, St. Ives, T. C. Cloud asked why we could get no positive answer to our questions concerning the quantity of metallic tin contained in the ore and in the tailing. A. E. Thomas replied defending the vanning-shovel assay and stating that in Cornwall they were chiefly concerned in the quantity of tin in the ore that their present appliances could extract, and this could be determined by the vanning assay. He claimed that the chemical assay was not necessary until they adopted a treatment that would extract more tin than at present could be determined by vanning tests. Alfred James drew a parallel to the experience on the Rand before the cyanide process was used, when panning tests were considered satisfactory. He thought the accurate fire-assay tests on the Rand ore made the owners realize the extent of their losses and paved the way for the cyanide process. So we left Cornwall without definite information concerning the loss. It is admitted that it is large, but why should the correct figures be withheld if extraction cannot be improved? An authoritative acknowledgment of the exact loss would be an incentive for improvements. A frank statement would certainly bring forth suggestions, if not solutions. When the tellurides at Kalgoorlie were first encountered the mines worked in unison to solve the treatment problem, and the ablest metallurgists of the world interested themselves. There is nothing to be gained by secrecy. Below the mills the Red river flows eight miles into the sea. At intervals there are 16 sets of independent 'streamers' working on tailing from the mills producing about 700 tons per year of concentrate averaging 45% tin.

It is not generally understood outside of Cornwall that there is not only a very wide margin of difference in the physical character of the ore in almost every Cornish mine but the analysis indicates a still greater variance in the mineralization. There is no similarity between the ore of Dolcoath and the adjoining South Crofty mine. The cassiterite at Dolcoath is extremely fine and it is accompanied by little arsenic and no wolfram. At South Crofty there is much coarse cassiterite and an average of 5 lb. wolfram with 35 lb. white arsenic. This accounts for the varying prac-

tice in the two mills. I gained the impression, however, that a far greater difference in treatment would obtain in all the mills if each mine made a more thorough study of its individual requirements. The present differences in the various mills indicate that those responsible are aware of the special problems involved, but the repudiation by some metallurgists and managers of the chemical assay is an admission of satisfaction that is not warranted at this late day.

There is no doubt that decided improvements are being effected everywhere. The county that can claim to have made and used the first rock-drill, the first tube-mill, the first

over a century and a half on its own resources under the inelastic hand-to-mouth financial policy of the cost-book system, and until quite recently the industry has been obliged to provide for improvements from profits won by antiquated means. When the present chairman of Dolcoath, Frank Harvey, can recall the various stages of haulage from the hemp capstan-rope 6 inches in diameter, efficient only for shallow depths, to the $1\frac{1}{4}$ in. steel rope on the Williams shaft, capable of handling 50 tons per hour from a depth of 3000 feet, the most pessimistic must bow to the courage, energy, and foresight of the Cornishman. These are the developments of 50



CORNWALL.

locomotive, the first wire-rope, that developed the Cornish pump and the pneumatic stamp, should be capable of taking care of its own industry. Mining and metallurgy, however, are based on exact science and the outsider finds it difficult to appreciate arguments favouring the inexactitude of the vanning-shovel assay.

The new Geevor mill will soon be in operation. Three machines new to Cornwall are to be tried: the Deister table, the Hardinge mill, and the Richards-Janny classifier. The results are worth watching.

In any criticism of Cornish methods it must constantly be borne in mind that mining in Cornwall has been continuously carried on for

years. Technical progress is more rapid now, and the opportunities for the advancement and trial of new ideas cannot be better indicated than by the presence of representatives on this tour from 16 societies and institutions all of them more or less directly interested in the progress of mining and the encouragement of those who seek to improve the methods employed. Cornwall has certainly to be credited with many devices used the world over, but it seems that they are the result of individual effort and do not represent the co-operative effort that has shown excellent results in other mining communities. Latent local talent should be encouraged.

In the early days of Cornwall, the Polytech-

nic Society, founded by Miss Caroline Fox and her sister, offered a prize of £500 to the mine that would first successfully operate a man-engine. The prize was won by Tresavean, and the man-engine was a great advancement in its day. Why not encourage inventive genius in the same way now, and no better way suggests itself than the financial support of the School of Metalliferous Mining at Camborne. This school is now maintained for the most part by fees from students, assisted by a Government grant and a small contribution from the County Council. Holman Brothers and other local merchants have been generous in meeting the requirements for machinery and appliances, and King Edward mine has been placed at the disposal of the students for instruction in practical work. But to make this school the power that it should be, financial support is most sadly needed. Provision must be made for a largely increased teaching force, and liberal remuneration is required to attract the best talent for lecturing. Here could be tested new devices designed to improve mining and metallurgical methods. The mines and the 'lords' could well afford to contribute generously to such a plant, where investigations could be conducted on a co-operative basis for the good of all. The policy of the school is now in the hands of 36 governors, of whom 22 are representative governors and 14 are additional governors. Last year there were 145 students, four for each governor. This is a burden of advisors under which the most thriving institution might well stagger. Select a strong man with executive ability, a good disciplinarian, give him financial support, but otherwise let him have full authority, and the school will take its place among the first institutions of the kind in the world. We are informed that the students now in attendance are a splendid lot of capable fellows, and would take full advantage of any increased facility for learning under proper discipline and a commensurate staff of instructors. Such a principal as we should like to see at the head of the Camborne school can be found inside the boundary lines of Cornwall. It does not necessarily require a highly technical man to fill this post, but a man of force and character in sympathy with the application of technology to mining.

In 1907 the question of labour in Cornwall became so acute that the importation of Italians was proposed, but never materialized beyond the suggestion. During the slump in tin, 1894 to 1898, Cornwall lost many labourers from emigration, and they have not returned. The

question of efficient labour is still acute. Grass Valley and Nevada City, the Lake Superior copper region, Canada, and Australia hold out inducements to attract the best miners. While we were visiting Cornwall 100 miners were preparing to leave for Cobalt, and the best men will continue to leave so long as a system exists whereby the prices and payments for contracts are restricted by or based on day's pay and not solely and entirely on the amount of work actually accomplished. There is no valid reason why Cornish miners should not earn as much and produce as much at home as abroad. We understand that at the Carn Brea and Tincroft the men are earning 50% more than under the former management, and the work accomplished shows more than a commensurate gain and the costs are lower. The methods employed at Carn Brea, and the results obtained are well worthy of enquiry.

Too much emphasis cannot be placed on the fact that Cornwall has all the ability if properly applied, and no better example can be given than the works of Holman Brothers. Here is a business that from being merely a local industry has faced competition in the machinery markets of the world. Nothing can speak more eloquently for the efficiency of the individual mechanic, the foreman, and the proprietors than the fact that they can build rock-drills and export them to the United States, paying 45% duty, and yet compete successfully with American products. The two large fuse-manufacturing plants near Camborne, and the rock-drill works of R. Stephens & Son bear out the possibilities of local efficiency. The firm of E. T. Newton & Son has been making theodolites and other scientific instruments in Camborne since 1823, and has established a name for excellent workmanship that would bear credit to better known and larger firms.

The lack of united action is illustrated by the demise last month of the London and West-Country Chamber of Mines, which had as officers and council some of the ablest men in Cornwall, and has died from lack of support after 11 years of usefulness. In West Australia and South Africa similar institutions have served a splendid purpose in giving wide publicity to every feature of mining enterprise. The tin output of Cornwall forms such a small portion of the world's supply that an increase or decrease in production will have no effect on the price. The element of competition does not enter into Cornish mining. Secretiveness only tends to fool the individual manager. Exchange of useful information is always helpful.

THE ENGINEER IN THE TROPICS

By T. LANE CARTER.

THE ignorance of most engineers about the diseases of the Tropics is almost as monumental as was mine when I first went thither. Having suffered from several of the plaques to which white men are exposed in the hot portion of the globe, it may help others who are going to those regions for the first time, if I put down some of the facts learned through a trying experience. When a man first goes to the Tropics from a cold climate, the energy which he brings with him carries him forward for many months and he does not realize the insidious forces working to break down his health.

The first mistake is generally made in regard to clothing. There should be a complete change from that worn in the North. This is not the place to enter into a discussion of the effects of excessive sunlight on the white race. The broad-brimmed hats of the natives should be adopted by the new-comer in place of the heavy hats so frequently used. The straw sombrero of tropical Mexico is an excellent headgear for this part of the world. Some prefer the cork helmet. The colour of the clothes worn is an important point to remember. The best outfit is underclothing of dark colour, with the outer clothing of white. These clothes, of course, should be light in texture.

The question of foot-wear is a matter of taste. I have seen men in the swampy parts of Central America wearing top-boots that would seem heavy in the tundra of Alaska. While it is necessary in these swamps to have boots to guard against snake-bites, the foot-gear should be as light as possible. In the dry parts of the Tropics, such as the mountainous regions of Mexico, the native sandal suits some people better than the heavier shoes. The champion walkers of the country generally wear these native sandals.

On the all-important question of food much can be written. Some maintain that little or no meat should be eaten in the Tropics, while others hold that this diet is beneficial. Judging from my own experience I should say that meat should be eaten sparingly. Much of the illness incurred in hot countries is due to the excessive consumption of meat, especially the imported tinned products. It is unfortunate that the engineer in a new district has to depend upon corned beef and other pre-

served meats sent from packing-houses thousands of miles away and held for months in a hot climate. In some camps in the wilderness it is possible to keep the men supplied with fresh meat. For this purpose it frequently pays to hire a hunter to kill game. In Central America the best hunters are the native Indians, who will go through the thick bush and kill one or two wild hogs when the white man could get nothing.

In a hot climate meat soon spoils. For this reason the natives of the Tropics shred the meat and dry it with salt. Wherever a mining settlement is fixed, it pays to instal a small ice plant. For £125 a machine of sufficient capacity can be installed. I know from experience what a god-send such a plant is. Not only does it make for better health, but it also reduces the cost of the food-supply.

To my mind the proper diet in these hot countries should consist largely of vegetables and fruits, especially the citrous fruits, such as limes, lemons, and oranges, grape-fruit, etc. The wholesale use of lemons I found most gratifying, not only as a diet but as a medicine during attacks of malarial fever. The citric acid seems to 'cool' the blood; acting quite differently from cereals, such as oatmeal, which tend to 'warm' the blood. The philosophy of foods in the Tropics is simply the antithesis of conditions in Polar regions. The Esquimo stuffs himself with blubber in order to 'thicken' his blood; the dweller near the equator should eat food to keep his blood 'thin.' The tendency is for white men in the Tropics to consume far too much protein food.

Whiskey may be a reasonable drink in a country like Scotland, but it certainly does not suit the hot climate. I know of a case, however, of a Cornish miner who for 15 years in Central America consumed enough alcohol to maintain a distillery, and who still lives to tell the tale. His case is exceptional. While he had to meet hard conditions, he was built with a constitution of iron. As a general rule it can be stated that alcohol in all its forms, including beer, is unsuitable for these hot climates, especially where malaria prevails.

It remained for Metchnikoff, the successor of Pasteur, to prove conclusively why alcohol is so deleterious in malarial countries. He has shown that the function of the white cells of

the blood, commonly called 'leucocytes,' but which he re-named 'phagocytes,' is to carry off the impurities in the blood. When a germ, such as that of malaria, enters the system, these phagocytes make war against the intruders, and if they are in good fighting condition overcome the invaders. Now Metchnikoff proved that the effect of alcohol on these phagocytes is to paralyse their action, so that when harmful germs enter the system they have an easy conquest. I have noticed on several occasions the poor fight put up by habitual drinkers when attacked by malarial fever. I remember once in a mining camp in Central America that nearly all the Europeans died during one season from malaria. The physician who investigated the cases told me that these men drank considerable whiskey every day and that when the fight took place in their blood the phagocytes were so weakened by alcohol that the malarial germs had everything their own way. If you are going to the Tropics for the first time, give up your whiskey and beer, and learn to be happy on lemonade.

There is another drink that is frequently used to excess in the Tropics, namely, coffee. The beverage is often made so strong that it has the consistency of soup. There are probably more coffee victims in the Tropics than in any other part of the world. I have noticed men whose hands trembled after taking this concentrated coffee in the morning. To my mind, much of the stomach trouble, especially chronic dyspepsia, is due in a large number of cases to the excessive use of this decoction. In such a climate tea is a better drink than coffee.

R. D. Ward in his work on 'Climate,' points out that the uniformly high temperature of the Tropics, especially when combined with high humidity, and the characteristically small diurnal variation of temperature, have certain fairly well established physiological effects. Among them the following are commonly noted: increased respiration, decreased pulse action, profuse perspiration, lessened activity of the stomach and intestines, and a tendency to digestive disorders, a depression of bodily and mental activity, enervation, indifference, disinclination to exertion, in fact, a general ill defined condition of debility, increased activity of the liver, super-excitation of the kidneys. In damp, hot air, evaporation from the lungs is slight; the blood becomes diluted, there is a deficiency in the number of red corpuscles in consequence of the diminished proportion of oxygen in the air. There is less power to do work, greater fatigue from work, lowered vitality. All this renders the body less able

to resist the first attack of disease.

As compared with the death-rate in colder latitudes, the tropical death-rate is high, but this fact should not be attributed solely to the dangers of the climate. Bad sanitary conditions and lack of medical attendance account for many, if not most, of the high tropical death-rates among the natives, and an irrational mode of life explains many deaths among persons coming from the cooler climates. Tropical death-rates are being reduced with remarkable rapidity in all countries that are wholly or partly under white control, and especially among European troops.

The scourge of the Tropics is malaria. The disease has afflicted humanity a long time. In an interesting book called 'Malaria Amongst the Greeks,' it is shown that this disease prevailed in the ancient civilizations and the author depicts vividly the effects of malaria on human development. All sorts of theories have been held regarding the origin of malaria, but it is only in recent times that the true cause of this disease has been discovered. The poison is injected into the human system by means of a species of mosquito known as the *anopheles*. The mosquito must first be impregnated with the poison before he becomes dangerous. One can imagine a part of the country in which the *anopheles* abound, where a traveller could live free from malaria in spite of the bites from these insects. Let a man, however, suffering from malaria come into this region and the *anopheles* would gradually become contaminated with the malarial poison. For this reason it is advisable to keep mosquitoes away from a patient by means of netting, for one man suffering from malaria can be the source from which the mosquitoes secure the poison to inoculate a whole camp.

The surest way of diagnosing a case of malaria is to examine the blood under a microscope. A little practice with this instrument will enable anyone to ascertain from the appearance of the blood what is the condition of the patient. It is possible to predict within a few hours when the malarial 'spasm,' commonly called 'chills and fever,' will appear, and to regulate the doses of quinine accordingly. It is most interesting to watch the effects of a solution of quinine on the organisms in the blood. Until the quinine is administered the organisms are active, but they are readily killed when they come in contact with the quinine. It would be well for the engineer who is to remain in the Tropics to devote some attention to the microscope and learn how to distinguish the effect of malaria on the blood.

Malaria affects people differently. In the majority of cases there is the intense chill followed by a fever. In some cases, however, a patient will not have a chill and only an occasional fever, and yet suffer from chronic malaria. I know the case of an Englishman, who after several years of prospecting work in British Columbia, went down to a malarial district in Mexico. This man had never heard of the disease. For a couple of years he enjoyed perfect health there, but after awhile his stomach became affected and he was forced to leave on a holiday. His doctors told him that he was suffering from chronic indigestion.

ment at the hot springs in Arkansas, he returned to the mine stronger and better than ever.

One of the most remarkable achievements of modern times is the success that has attended the efforts of the American government in the building of the Panama Canal. Here was a district where the French lost thousands of lives from disease. So successful has modern science been in stamping out malaria in the Panama Canal zone, that today the death-rate in this part of the world is lower than in many of our largest cities. It is now proved that malaria is a preventible disease.



A RAILWAY IN THE WEST AFRICAN BUSH.

After his return to Mexico his illness came on again and he was in despair of ever regaining his health. Fortunately he fell into the hands of a physician skilled in the treatment of fevers, who examined his blood and then told him that he was suffering from chronic malaria. The doctor commenced dosing him with quinine and the effect was magical.

While malaria is a serious disease and very troublesome, yet there is this great advantage that the patient is readily cured when he leaves the malarial region and takes a course of treatment in another climate. Once I saw an engineer carried out of a malarial district in Central America. He had been 'out of his head' for days and we thought it best to send him to the States to die. After three months' treat-

"No mosquitos; no malaria" is an excellent motto for the engineer in the Tropics. By clearing the bushes around the dwellings; by placing the houses on an elevated spot; by draining any stagnant water or placing paraffin oil on the stagnant pools; by using mosquito netting; by taking quinine when the microscopic examination of the blood shows that it is required, malaria can be practically overcome. In a paper written for the American Institute of Mining Engineers, I gave a few rules to be observed in the Tropics in regard to malaria. As I have been told by several young engineers that they were helped by these suggestions, I take the liberty of repeating these rules:

1. Don't forget the prophylactic use of qui-

nine in a malarial district. A dose of three grains of quinine bisulphate before each meal should be taken regularly. Constipation should be fought, preferably with a fruit diet, but if this is impossible then purgatives even as strong as calomel must be used.

2. If the fever or chills strike you, go to bed. Profuse perspiration should be induced by drinking hot lemonade. If the sweating is not copious enough, then some antipyretic, such as acetanilid, antifebrin, or phenacetin, should be given. Ten grains of one of these drugs is a dose.

3. If the patient is attacked by violent vomiting, which frequently happens, the best remedy is 30 grains of ipecacuanha, with plenty of tepid water. When the stomach is empty, a dose of five grains of cerium oxalate and five grains of sodium bicarbonate will bring relief.

4. Treatment with quinine should now begin. From 15 to 20 grains of quinine are given, the dose being administered three times a day. Sufficient quinine should be taken to induce cinchonism. Quinine given in excess of that required to induce moderate dizziness is not necessary.

5. The use of calomel in Northern countries might be open to criticism, but in the Tropics, where the liver becomes so torpid, there seems to be nothing to take its place. It is important in the treatment of malaria; 10 grains of calomel mixed with an equal weight of sodium bicarbonate is an average dose. It is best to divide the dose into four parts, and take a quarter of it every 20 minutes. This prevents the griping pains attending the use of calomel.

6. About six hours after the dose of calomel is taken, an ounce of magnesium citrate dissolved in water should be given; and two hours later a large dose of quinine (say 20 grains) should be administered.

7. The patient should remain in bed for at least a week. Quinine is given two or three times daily to the amount of 30 to 35 grains per day, until 25 days have passed without a return of the fever.

8. At times arsenic, in the form of Fowler's solution, is preferable to quinine. Five drops in water, three times a day before meals, is efficacious. This tonic should not be taken for more than 10 days.

9. When anæmic, iron is necessary. Five-grain pills, containing 2½ grains each of iron carbonate and sodium bicarbonate, should be used; two of these pills to be taken after each meal.

10. There are of course many helpful books

on the subject. That of Dr. Schaubé, 'Diseases of Warm Countries,' published by P. Blakiston & Sons, of Philadelphia, will be found suggestive.

Quinine comes in many salts, the one most used being the sulphate. Frequently this is put in hard sugar-coated pills which may pass through and out of the system without a particle of the quinine getting into the blood. Such pills should, of course, be cracked before they are swallowed to give them a chance to dissolve in the stomach. Without such precautions a large amount of quinine taken may be absolutely wasted. The great objection to the sulphate of quinine is its insolubility. Preferable salts for the Tropics are the bisulphate and the hydrochloride.

While snakes and snake bites cannot be considered as a disease, the subject is of sufficient importance to be mentioned in an article of this kind. A life might be lost in a very short time through ignorance as to the remedies to be used in case of a bite from one of these poisonous reptiles. In some districts in the Tropics there are few snakes, while in others they abound. In cold climates, poisonous snakes congregate in great numbers in cavities in the rocks, in the cold season. In tropical climates, this hibernation has an equivalent in æstivation, by which term the scientist has designated a similarly lethargic state during the hottest and driest portion of the summer.

Numerous snakes are found in the Tropics, including the python, the black snake, the corali, the taboba, and the rattle-snake. In travelling about, the engineer should have in his medicine chest some remedies for snake-bites. In the case of a bite from a poisonous snake, one authority advises the following procedure:

"The first thing to do is to tie a ligature or two between the wound and the heart, next cutting deeply into the punctures so as to make the blood flow freely. Sucking out the blood from the wound is a procedure perfectly harmless, unless the person doing it has an open wound in his mouth. The ligature should be loosened now and then. Small doses of alcoholic stimulant should be given freely. A tincture of iodine (made in proportion of one large tablespoon of water to five drops of pure iodine) is given to the patient, six drops every half hour.

"For the lesions two or three drops of an aqueous solution (1 to 100) of chromic acid should be injected with a syringe exactly into the puncture of each fang. It is necessary to

let the liquid penetrate into the tissues to the same depth as the venom.

"If at the time of treatment the swelling has already obtained a certain size, it may be necessary to make injections into various parts of the tumour. After the injections the part is pressed gently with the hand so as to distribute the injected fluid in all directions and to facilitate its mixture with the venom. A small piece of lint soaked in chromic acid solution is applied to the wound."

The natives of the Tropics have many remedies for snake-bite, but superstition rather

of pneumonia. The method of treatment seemed to give poor results, and hundreds of men, women, and children died. My friend, who was in charge of one of the camps, introduced this method of treatment, with great success. He has since used it in treating pneumonia in the Tropics, and has so far cured almost every case of the malady that has come under his care. Here is the remedy:

Give the patient a dose of 5 to 15 minims (drops) three times a day of tincture of aconite. At the commencement of the disease, aconite should be used as a febrifuge, 1 minim



HAVANA.

than fact is the basis of their cure. The brain of the snake, dried in the sun, powdered, and then swallowed hurriedly, is supposed to work wonders. Some of the indigenous herbs are also used.

Pneumonia is generally associated with cold climates and high altitudes, but the disease occurs in the Tropics as well, especially in mountainous regions. Pneumonia is a serious disease and the death-rate in the Tropics is high. There are many methods of treatment for this malady, but I should like to give a remedy I saw used with extraordinary success by a friend of mine during the Boer war. It has the authority of the British pharmacopœia. At one time in the Burgher camps in the Transvaal and Natal, there was an epidemic

every 10 or 15 minutes for an hour; then repeat the dose every hour until the skin is in profuse perspiration. Aconite has a profound influence on the heart and this organ must be watched carefully.

While the medicine is being given to the patient, hot linseed poultices should be applied to the chest every hour, great care being taken that the poultices are not allowed to grow cold on the skin of the patient. Usually this method of treatment cures the disease within a few days.

Next to malaria, the disease of the Tropics that is most dreaded is dysentery. I have noticed that this disease is more common in the dry parts of the Tropics than in those where the rainfall is abundant. The reason

for this is obvious. Where water is scarce the pools and the wells become contaminated and the disease is caught by drinking this impure water. Where the rainfall is abundant the water is not as liable to be contaminated.

Only those who have seen cases of chronic dysentery know what an awful disease it is. It is by no means as simple a malady to treat as malaria, and I have known several engineers to leave the Tropics to put themselves under the care of some great specialist. It takes money to cure this chronic complaint. When the malady is of a mild form, it can be immediately checked by following this simple remedy, namely, by taking a pill three times a day composed of 10 grains of bismuth subnitrate and 5 grains of Dover powder.

Dysentery in the Tropics is caught in two ways: in eating and drinking. Bad water is the principal cause of infection. For this reason it is most important to boil all water before drinking. I know an engineer who has been in the Tropics for years without a day's illness, who is a crank on the subject of boiling water. He carries it to extremes, but his fad has preserved his health.

It is so easy to sit in a cushion chair and write that all water should be boiled before drinking, but when a man has gone for hours in the tropical sun and at last approaches water of any description, he forgets the importance of boiling the water. I know from painful experience the difference between theory and practice in such cases, for I nearly lost my life once from thirst, and at the moment would willingly have taken water charged with every bacillus under the sun. There is a little trick sometimes used by prospectors in the Tropics which the engineer should remember, namely, that foul water can frequently be helped by the addition of charcoal. Once in South Africa I saw an experienced prospector save a party from dysentery and possible death by preventing them from drinking the water from a foul pool. The prospector built a fire and put a gallon of water in a pot to boil. Then he added bits of charcoal which he had made. A dirty scum gathered on top of the water, and was skimmed off as rapidly as it was formed. In this way the water was completely purified. The taste was, to put it mildly, rather disagreeable, but the water was perfectly wholesome.

At one time yellow fever was one of the greatest curses of the Tropics, but science has overcome this evil and it is probable that our generation will see yellow fever disappear altogether from the face of the earth. There is

no more extraordinary story in modern science than the transformation of Havana from a hot-bed of yellow fever under the Spanish regime, to the present condition of immunity from the dreaded disease. Like malaria, this malady is also due to the mosquito. In the Tropics among the numerous species of mosquito, we frequently find this yellow-fever mosquito. This should cause no alarm, however, for until he is contaminated from a yellow-fever patient, the insect is harmless.

It is generally believed that the white race degenerates in the hot zone. The engineer is advised to take a holiday in a cold climate after a few years spent in the Tropics. This part of the world is becoming more important every day and the call for engineers to make their life-work in the Tropics is larger every year. Medical men now teach that much of the deterioration and ill health of the white race in hot climates has been due to ignorance of the laws of health and the changed condition of the environment. More and more attention is being given by physicians to the study of tropical medicine, and many men are now making a specialty of these diseases. Much has already been done to make the Tropics habitable for the white race. In this great work the doctors take a leading part, but the engineers are their right-hand men in devising schemes of drainage and sanitation.

It would be well for the engineer going to the Tropics for the first time to take a course of study of the diseases peculiar to this part of the world. The responsibilities resting on his shoulders are sometimes very great. He is often called upon to open up mining regions where there are no doctors. An elementary knowledge of tropical diseases and their treatment might save not only his own life but lives of the men working with him.

The Output of Coal in New South Wales during 1911 is reported at 8,691,604 tons, valued at £3,167,165, being an increase of 518,096 tons and £157,509 as compared with the year before. The shipments from Newcastle to other Australasian ports amounted to 2,525,776 tons, and to overseas ports 2,498,304 tons. The coke industry, on the contrary, shows a decline, the output for 1911 being 264,687 tons, or 17,650 tons less than in 1910. The number of men engaged in coal mining was 17,657. The output of pig iron was 36,354 tons, and of steel ingots 4,838 tons; the iron industry was depressed on account of labour troubles.

DISCUSSION

Our readers are invited to criticise anything appearing in this magazine and to discuss other subjects of general technical interest.

Mining at Bendigo.

The Editor :

Sir—Of late there has been a general revival in this district, and dealings on the local stock exchange have been brisk. When referring to deep sinking at Bendigo, some time ago, you expressed the opinion that mining was as likely to be profitable above 1000 ft. as below it. This has proved to be so. Deep sinking, especially along the New Chum line of lode, has been proved unprofitable; consequently many mines are shut-down. In consequence of this exploratory work, more attention is being paid to the upper levels and side lines of the group, with the result that

appears that the deep-sinking mania was often condemned, but the old school here would not listen, nor take expert advice. There is one point though to be noted, namely, that the shafts, cross-cuts, and drifts put out during deep sinking, will prove very useful in the present development, and so lighten the cost. Metallurgical operations are improving slowly, and a great contrast is noticeable between Lansell's Fortuna 48-stamp mill and the Central Blue of 20 stamps next door, the former the old type, hand-fed mill, and the latter fast-driven by suction-gas engines.

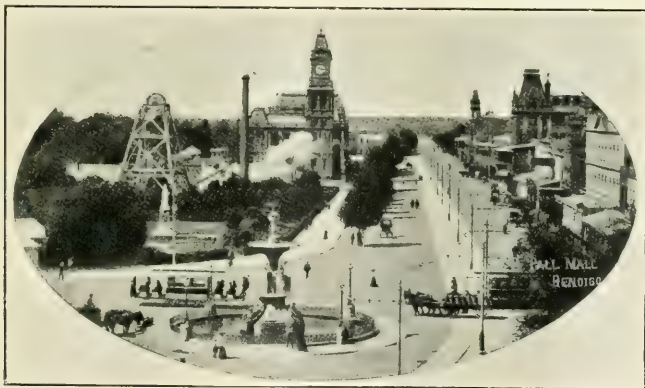
M. W. VON BERNEWITZ.

Bendigo, June 12.

Early Days at Kalgoorlie.

The Editor :

Sir—The thanks of your readers are due to



PALL MALL, BENDIGO. ALSO THE HUSTLER'S ROYAL RESERVE MINE.

highly profitable ore is being worked. This applies particularly to mines along the Derby and Sheephead lines. The Prince of Wales, below the Catherine Reef United, is doing well; also the Central Red, White, and Blue and the Golden Pyke; Johnson's Reef has cut 'formation' at 1150 ft., and opened up along 270 ft. The saddle has not yet been proved, and cross-cutting is under way to prove the east leg. The Sheephead has finished sinking to 500 ft., and is cross-cutting. Hustler's Royal Reserve, in Bendigo, is cross-cutting to the Hustler's Extended. From September 1910 to April 1912 the Central Blue has milled 21,749 tons for 33,561 oz. bullion, and paid £80,000 in dividends. From general conversation with mining people here, it ap-

pears that the deep-sinking mania was often condemned, but the old school here would not listen, nor take expert advice. There is one point though to be noted, namely, that the shafts, cross-cuts, and drifts put out during deep sinking, will prove very useful in the present development, and so lighten the cost. Metallurgical operations are improving slowly, and a great contrast is noticeable between Lansell's Fortuna 48-stamp mill and the Central Blue of 20 stamps next door, the former the old type, hand-fed mill, and the latter fast-driven by suction-gas engines.

There are three matters of particular interest connected with this period: (1) the discovery of gold telluride compounds, (2) the introduction of the filter-press, and (3) the entry of the tube-mill.

The Johnson press, erected at the re-organized Brownhill mill, was the first press to treat slime profitably from Kalgoorlie ore. Experi-

ments were conducted on the Brownhill ore in Germany in 1896, by the London & Hamburg Gold Recovery Co., through the agency of Bewick, Moreing & Co. In 1897 the first Johnson press was operated at the Hannan's Brownhill mill. In 1898 the 5-ton Dehne presses of the London & Hamburg Co.'s mill on the same mine commenced operation.

Apparently Kalgoorlie was not the first to adopt the filter-press to the treatment of gold-ore slime. While on a voyage, in 1903, to Nicaragua, to instal one of the first crushing-in-cyanide all-sliming plants for the Leonesa mine, designed by Philip Argall, Mr. Dempster informed me that in New Zealand (I think it was at the Crown mine, about the year 1893) the filter-press was utilized for the treatment of slime by the Cassel Gold Extracting Co. Presumably no marked success resulted.

With regard to the introduction of the tube-mill at Kalgoorlie, this again is attributed to the London & Hamburg Gold Recovery Co. with Dr. Diehl, as metallurgist, in the re-modelling of the Hannan's Star mill in 1899. Here, once more, is a contestant, for the *Mining and Scientific Press* of July 6 contains this paragraph: "Tube-mills were first used for the fine grinding of ore in 1894 at the Moulton mill, at Butte, according to R. F. Abbé." It would appear, therefore, that Kalgoorlie's brilliant metallurgical record cannot include an uncontested claim to the introduction and adaptation to gold-ore treatment of either filter-press or tube-mill, although the success attending both is beyond question.

The filter press was borrowed from the sugar-refining industry, and the tube-mill from the cement industry. Both have been improved, in the former case almost beyond recognition. It is of interest to note that the vacuum-filter is now being utilized in sugar-mills for the treatment of the crushed cane, and the recovery of that considerable portion of the sugar remaining with the pulp that formerly was lost.

The entry of both filter-press and tube-mill were epoch-marking periods in the metallurgical treatment of precious-metal ores, and it is desirable that authentic data should be recorded. Mr. Maclaren has enlightened us on the discovery of gold-telluride compounds at Kalgoorlie. Is it too much to ask those directly responsible for the introduction of the filter-press and tube-mill into New Zealand and Colorado respectively, as suggested above, to be equally obliging?

London, July 21.

H. E. WEST.

Phantom Profits.

The Editor:

Sir—Is not this misuse of the word 'profit' due to many promoters, directors, and engineers not being aware that mining operations should be based on the ordinary principles of business, and that precisely the same laws should hold good in mining as in the trade of the grocer, the manufacturer of machinery or chemicals, or even of the professional man. The first law is that you must conserve your assets. A lawyer or medical man is bound to write-off every year from his net earnings a certain amount against the depreciation of his intellect and bodily strength, and to provide against an entire extinction of his mental assets. A maker of machines, in addition to placing part of his profits to the maintenance of his establishment in good order, has also to apply another portion to experimental work with a view to improving his specialties and keeping up with the times; also to investigate new ideas and new lines of manufacture, just as the owner of a mine has to spend money on prospecting and development. The market for his goods may come to as sudden and unexpected an end as a gold-bearing vein, owing to a rival placing an improved apparatus on the market. He may have some highly profitable side-line that may suddenly be extinguished by a change in fashion or by some purely accidental circumstance. From these considerations it is obvious that the manufacturer has to put by large sums in order to conserve his assets, and if the manufacturer has to do so, why does not the company owning a mine? No manufacturer of machinery or chemicals would dream of subtracting his cost of materials and labour from the amount of his sales and call that a profit. Yet that is what many directors of mining companies do. Sound business men and many firms of accountants stand aghast at the improvidence of the mining companies in matters of finance. To begin with, the capitalization of chances is a dangerous principle. It may be allowable to capitalize the profit obtainable from probable or even possible ore in this way, but to add the unknown contents of the lode for the depth of two levels below the lowest working or borehole is a proceeding not based on business principles. Then every succeeding year the question arises as to the valuation of the assets. The mine must necessarily be the less valuable by the amount of ore removed, yet nothing is done to indicate this fact in the balance-sheet. The basic principle should be to write off nearly the whole of the

capital value of the mine and of the machinery and to replace this by cash or securities. It is proper, of course, to retain the estimated saleable value of the plant, and if, when the figure for the value of the mine has been substantially reduced, the mine is still productive, to let it remain at that level.

The question as to whether such funds are to be re-applied to another mining venture, or not, now arises. Many people urge that mining companies should perpetuate themselves in this way, being of opinion that it is well to utilize an established business organization. On the other hand, others consider that a mining company should be a 'one-object' company. In the latter case the accumulated funds should be distributed as return of capital from time to time. The difficulties in the way of such proceedings arise from the technicalities of company-law requirements, but they are easily overcome, and they have been overcome by such organizations as the Tharsis, Mason & Barry, and Mountain Copper. It would be best, however, to start on these lines from the beginning and give every subscriber a debenture secured on the estimated profit from the known ore reserve, and, as a bonus, an ordinary share based on the speculative element. The debentures would be redeemed from time to time. The views expressed in this letter do not cover any great extent of ground, but I trust they will help in the discussion.

EDWARD WALKER.

London, July 20.

The Editor:

Sir—I have read your editorials on 'Phantom Profits' with great interest, but I cannot entirely agree with you on several points. You conclude these leaders by saying: "The three factors are yield, cost, and profit. All other items of account represent intermediate stages of book-keeping. The central purpose of mining . . . is to make money."

The central purpose of good mining, however, is not merely to make money; this might be done without the aid of accounts in the case of some mines, but to make the maximum of net profit out of a mine, due regard being paid to the rate of realization of the profit. The three factors in good mining, therefore, are yield, cost, and the profit as indicated above. All items of account, including periodical balance-sheets and dividends, etc., until the final closing of the books, represent intermediate stages of book-keeping co-ordinated to this great central purpose. This ultimate purpose should

be kept in view in any criticisms which may be passed on details of mine accountancy, otherwise conclusions drawn from periodical statements of divisible profit alone may lead to erroneous views of the true industrial position.

Under the heading of 'Definitions,' you allege that it is undesirable to speak of 'operating profit.' The terms 'operating cost' and 'operating profit,' which is the difference between the 'operating cost' and the yield are useful and convenient terms in mine accountancy. The operating cost is a matter of the greatest importance to the mine-manager, while the operating profit is equally so to the directors of a mining company, for upon this profit many questions of directorial policy must depend. Hence both these matters are of prime importance to engineers. Why, then, is it undesirable to speak of such a profit? It is indeed undesirable in many instances to use the word 'profit' unaccompanied by some qualifying term to indicate what kind of profit is meant. Manufacturing profit, trading profit, gross profit, distributable or divisible profit, are all profits. These and similar phrases are part of the every-day language of commerce and accountancy, but the word 'profit,' standing alone, would often be ambiguous since it may mean merely a departmental profit or something radically different from distributable profit; thus it may be misleading to a shareholder.

It is to be sincerely hoped that, as a result of your discussion of 'Phantom Profits,' greater care will be exercised in future in regard to the use of the unqualified term 'profit.'

In connection with the terms 'operating cost' and 'operating profit,' it has to be admitted that there is a great lack of uniformity in mine-accountancy practice in regard to the items that are included or excluded from 'operating' cost. These items vary considerably with different companies. I submit nevertheless that only the veriest simpletons in commercial matters would assume 'operating profit' to be identical with either net or distributable profit. Standardization of accountancy practice is surely the remedy, rather than abolition of these two terms.

I would include under the term 'operating cost' every item of expenditure during a period, with the exception of the following: (A) Financial adjustments that may be made more or less arbitrarily by the directors of a company, such as allowances for capital depreciation, for instance, which are generally determined in reference to the financial position and future outlook, and are not usually based

on considerations of the tonnage milled during the period. (B) Expenditure incurred in preparation for the mining and treatment of future tonnages.

Accounts should reflect the organization of an undertaking and they should therefore show, among other things, the efficiency or inefficiency of its various departments. While the net monetary increase and distributable profit are undoubtedly the matters of supreme interest to shareholders, they, as partners, should be placed in such a position that they may easily differentiate between financial adjustments made at the discretion of their directors, and the balance of expenditure, which depends largely on administrative efficiency and economy at the mine and in the home office. 'Operating cost,' 'operating profit,' 'net increase,' and 'dividend' would thus have a definite significance in relation to the details of mining-company organization.

Calculations of cost per ton are useful in mine-accountancy up to a certain point, but they may be strained to such a degree as to become misleading. You appear to me to have stretched this useful method of analysing current expenditure beyond the really practicable point when you attempt to determine the 'total,' 'real,' or 'actual' cost per ton by means of calculations based on the periodical dividends. Certainly the fundamental fact is that any difference between yield and dividend is expense, but, in the case of any going concern, there is indeed a nice difference between expenditure incurred during a period and the cost of handling a certain number of units during that period. Additional expenditure for future contingencies will inevitably be incurred at all times during the active years of the life of a mine, but this expenditure should be debited to future tonnage, not to a certain quantity of ore that happened to undergo treatment during the time those expenses were incurred. If we are to mingle the necessities of the past with the requirements of the future in our accounts and calculations of 'cost per ton' as applied to an antecedent tonnage, then our book-keeping will cease to be intelligible and 'cost per ton' will become a meaningless and valueless term. You say that the profit is measurable only by the dividend, plus the increase of cash on hand. Acting on this principle you proceed to calculate the 'actual' total or 'real' cost per ton at a number of mines by subtracting dividends from yields, though it is clear that a mine may pay many dividends and yet be an unprofitable venture when the initial capital outlay is taken into

consideration. Many mining companies do not make any allowances for capital depreciation. In such cases your method certainly cannot be said to give the 'total' or real cost per ton. It is not possible, in my opinion, to accurately assess the 'real,' 'actual,' or 'total' cost per ton in the case of most metal mines since the tonnage over which many expenses must be spread is indeterminate. I submit, therefore, that these terms are liable to be misleading to shareholders, and should not be used in this connection.

If it is necessary or desirable to calculate every item of expense on a tonnage basis in annual and other statements of account, then then let us rather speak of operating cost per ton and additional expenditure per ton. A distinction is thus drawn between expenditure on ore treated and that on ore to be treated.

In conclusion, I would plead for greater uniformity in mine-accountancy practice in regard to the term 'operating cost,' as the practical remedy for the state of affairs that you have so ably discussed.

W. H. GOODCHILD.

London, July 28.

The Editor :

Sir—I agree with you as to the great desirability of having a standardized definition of the term 'profits' for use in official statements of accounts instead of the many vague usages of the term now observable to which you rightly call attention. This vagueness of expression, however, is, I believe, by no means confined to the accounts of mining and metallurgical companies with which primarily you are dealing. Similar instances will, I think, be found in the accounts of public companies in many other branches of industry.

I think primarily it is not the function of a mining engineer to deal with this matter. He is not necessarily an expert accountant; so, in my opinion, the Institute of Chartered Accountants should take some action and make for the use of their members some official pronouncement on this matter, as it is to them we look for the correctness and accuracy of our statements of accounts.

You rightly commend the practice of those companies whose statements of 'profits' approximate most closely to the sums actually available for distribution or for a reserve fund, or otherwise accounted for in some way. I think there is in general a lack of touch and co-operation between the mine manager from whose office the accounts originally emanate and the accountant who finally certifies the balance-

sheet. Generally speaking, there is not much fault to find with the rendition of the local statements of cost rendered monthly, but there are in many cases many items paid or payable annually or periodically from the head office which must be incorporated in these accounts. Many companies find it inconvenient to refer to the local accountant such items, preferring to adjust them on this side without the local knowledge of the general manager and accountant. The profit on local cost is, of course, the difference between the actual local expenditure on revenue account and the net revenue produced, but as you have pointed out, other expenditure which is properly classified as cost against revenue production is subsequently added to these accounts and here generally, I think, is where the great differences in usage occur. While on this point, I might indicate what I think is a still more serious point in connection with statements of accounts, namely, the great differences in the methods of allocating expenditure to revenue and to capital account.

A superficial inspection of published statements of accounts will often show exactly what amounts have to be deducted from the so-called apparent profits, as stated, to arrive at the actual profits, but if in the original accounts expenditure on revenue account has been wittingly or unwittingly allocated to capital expenditure, the balances of apparent profit become phantoms of a much more dangerous character than those you indicate.

I had several conferences with members of the Institute of Chartered Accountants on this matter of the standardization of mining accounts when I was chairman of the Institution of Mining and Metallurgy's sectional committee on the standardization of mining accounts, and at one time I hoped the Institute of Chartered Accountants would see their way to have appointed one or two representatives to confer with our committee and to arrive at some definite decision on some of the knotty points we dealt with. The result of our discussion showed how difficult it is to formulate hard and fast rules and laws for the apportionment of expenditure of this class. All we can do is to enunciate and define the fundamental principles on which accounts should be adjusted, or rather to get the Institute of Chartered Accountants to collaborate with us in doing so.

For instance, expenditure which one year is properly carried to capital expenditure, thus relieving revenue expenditure to that extent and making the apparent profits greater by that amount, may in the following year be shown

by subsequent operations to have no recoverable value and to have become a charge on revenue. In such cases the practice is to write off the amount over a period of years, but, in point of fact, the amount represents a loss on the particular year when the expenditure was made, and, if it had been definitely ascertained, would have been written off then. It follows that the statement of profits for that year must necessarily have been of this phantom character, the extent being dependent upon the extent of the amount improperly carried to capital expenditure.

I am sorry I have no time to write at greater length on this interesting subject. I should be glad indeed to see the subject well ventilated in your columns by our chartered accountants as well as by those of our mining engineers who have had special experience in this matter.

W. H. TREWARTHA-JAMES.

London, July 29.

Sir—In your interesting series of articles entitled 'Phantom Profits,' you have, so far as I am aware, been the first to draw public attention to a reprehensible system of 'window-dressing' in the presentment of mining accounts.

In the vast majority of cases there is presumably no reason to suppose that this system is purposely designed to conceal facts or in any way to mislead shareholders or the general public. It would rather appear to be the outcome of a desire that the merits of any mining undertaking, in comparison with other similar concerns, shall not be obscured by applying to it a too rigorous method of profit calculating. In other words, the system appears to be due largely to a competition in 'standardized' costs, in consequence of which there is a temptation to regard and treat as extraneous, exceptional or supplemental 'charges,' items that should strictly be regarded as 'working costs.'

In the annual accounts of a mining concern such 'charges' are generally dealt with under a No. 2 Profit and Loss account or in the Appropriation account. Assuming that the ordinary or No. 1 Profit and Loss account is to be of service for statistical and comparative purposes, there probably are good reasons why a number of items should be dealt with by a secondary process in this way. Obviously, a quite exceptional and non-recurring capital expenditure out of revenue as, for instance, for an increased equipment, is best and quite naturally kept out of the No. 1 Profit & Loss

account. Then again a repayment of debt, or a payment of interest on debentures out of revenue, is only a way of dealing with a profit or part of a profit earned and can obviously find no better place than under Appropriation account. Much may also be said in favour of dealing similarly with profit taxes and commission on profits. We cannot, therefore, I think, object to the method followed in most annual accounts of stating the profit in two stages. The Profit & Loss account, in conjunction with the Appropriation account, shows the result of the year's working and a shareholder should be able to draw his own conclusions respecting future prospects, provided secondary charges under Appropriation are confined to such items as can legitimately be regarded as in the nature of a distribution of profit. What I consider quite misleading, however, is that in a majority of mining companies the No. 1 Profit & Loss statement takes no account of such items as Main Shaft Sinking and Renewal of Equipment, which really are wholly or in part constantly recurring or periodic expenditure. If it is necessary to debit No. 1 Profit & Loss with an adequate proportion of development expenses, as Development Redemption account, why should not the expenditure on the shaft or shafts be redeemed in the same way and why should not renewals of plant (apart from current repairs) be similarly provided for? By charging these items bodily to Appropriation as 'Capital Expenditure out of Revenue' the impression is conveyed that these are exceptional charges, not affecting the inherent profit-earning capacity of the mine. If this does not actually result in the Phantom Profit becoming the Father of the Illegitimate Dividend (out of Capital) at least an illusory degree of prosperity is indicated. One can fancy the shareholder rubbing his hands and saying: "Ah! when we have finished this Capital expenditure, we shall get nice dividends." How is he to know, poor man, that when the "Capital expenditure" in question is finished he will be appreciably nearer receiving his final liquidation dividend—if any? Is it too much to expect that the Profit & Loss account shall give a true indication of the inherent profit-earning capacity of the mine and that the Appropriation account shall show only how a real profit has been dealt with?

As regards the monthly-profit statements of mining companies, these in general correspond to the No. 1 Profit & Loss account in the annual statement and therefore represent, as you put it, an intermediate stage of book-keep-

ing. If they are intended strictly as a means of comparison between one month's results and another, they may conceivably serve a useful purpose. As an indication of the probable financial position at the end of the year, they are in the majority of cases an absurdity. The use of the term 'working' profit is presumably intended to obviate misconception. But while in some cases, the "working profit" is subject to deductions of relatively small amounts, such as profit-tax, in other cases it will be largely—sometimes entirely—absorbed in directions other than the payment of dividends. Unless and until all mining companies agree what is and what is not a working cost it is necessary that something a little more explanatory than the euphemism 'working profit' should find a place in the monthly announcement. It would be sufficient, for instance, to state that the 'working profit' is "subject to provision for tax, etc.," the *ceteras* being specified, and including allowance for shaft-sinking and plant-renewals in cases where directors cannot bring themselves to do the right thing and charge a proportionate part of the expenditure on these direct to the monthly working cost.

Taking a round dozen of South African companies at random I find that for the year ending December 31, 1911, their 'working profit,' as shown by Profit & Loss account, aggregated £2,231,590. The real available profit of these same companies (available, that is to say, for dividends, for reduction of debt, or for increasing the cash reserves) amounted to £1,574,080. The real profit therefore averaged only 75% of the working profit. The difference of 25% is a measure of the illusion that monthly statements as customarily issued tend to foster. I have not selected mining companies of the Rand as being any worse than others, but rather because we are accustomed to look there for light and leading. It is to be feared that one result of striving to standardize costs for statistical and comparative purposes is the tendency to standardize the worst features of the 'window-dressing' of accounts and monthly statements of profit.

While the principle involved in showing real profits is the same in a prosperous as in a struggling concern, it is obvious that a departure from it involves a greater proportionate error on a small margin of 'working profit' than on a large one.

With everything possible done to give the shareholder a clear indication of the progress of his undertaking, there are, it is true, still factors that cannot well be included in a

monthly statement and he must be supposed to have satisfied himself on such points as, for instance, the life of the mine and the indebtedness of his company. That, however, must not be made an excuse for withholding reasonably accurate information where such is possible. The whole question might be regarded as one between the shareholders, the directors and the accountants. But where it touches the Engineer is that if he submits an honest estimate of the *real* profit from a property in the neighbourhood where the phantom profit stalks, he almost inevitably gets a damaging reputation of being ultra-pessimistic.

Your efforts at reforming mining accounts have my wholehearted sympathy and approval. I wish you every success in your endeavours.

W. R. FELDTMANN.

London, July 31.

Professors and Business.

The Editor:

Sir—I was interested in your editorial in the July number of the Magazine, entitled 'Professors and Business,' and fully agree with what you say. As you know, the practice of visiting mines and metallurgical works in the summer vacation is almost universal among men best qualified to teach, and in most of our mining schools the practice is increasing of having specialists lecture to the advanced students, giving from their experience the application of the theories which have been taught by the regular staff.

There is another side to this proposition which you do not mention; and that is, that occasionally the young graduate opening a professional office or starting an assay laboratory, has sometimes felt that he had a grievance against his former professors, because they competed with him in professional work. A professor, under a salary, having his laboratory rent free and either permitted to use the apparatus and reagents of the school without charge, or at least to import some of them into this country duty free through the institution with which he is connected, can well afford to charge for consulting or analytical work at a much less rate than the man who has rent to pay and is obliged, in addition, to purchase fuel, electricity, and reagents. Probably this is a small matter, but would have some weight.

On the other side of the question, it must be considered that although some professors, as you say, have made mistakes which reflect seriously upon the credit of the institution to which they belong, there have been men who have

done brilliant work in the engineering, electrical, and chemical fields, which has not only brought increased financial income to them, but has greatly added to the prestige of the institution to which they belong.

ALBERT R. LEDOUX.

New York, July 25.

Randfontein Central.

The Editor:

Sir—Among the remarks in your May issue on certain changes at Randfontein made by Sir J. B. Robinson there is one which, I am sure, were you acquainted with all the facts of the case, you would have written in a different strain. You say "*As against* a number of capable and experienced men Sir J. B. Robinson has appointed his brother-in-law, Mr Colin Ferguson, as general manager." Mr Colin Ferguson may be a brother-in-law of Sir J. B. Robinson, and obviously for that reason better known to him than other men of equal experience could be. And whom would the shareholders prefer to guard their interests *ceteris paribus* than a man for whose personal character the largest shareholder could personally vouch?

The facts of the case are that in 1893, Mr Ferguson, after a first-class education at a South African public school, entered the employment of the Porges Randfontein company in the subordinate capacity of assistant-assayer and at the usual rate of pay. I may say that I myself, although only a learner, was much more highly paid than he. Since then for 19 years, except during the War, when he was, I believe, at the front, he has been regularly employed, and in open competition with other employees, learning mining-work generally, and if 19 years steady application to his duties is not sufficient experience in the opinion of all the shareholders to warrant his appointment in the prime of life to the control of any mine, it would at least, I think, compare favourably with that of most mine-managers at the time of their first appointment to such a responsible position.

W. R. T. FRANK.

Queen's Mine, South Rhodesia, June 30.

[We are glad to publish this letter. No slur was intended to be cast on Mr. Ferguson's technical qualifications, for we understand that he has more than served his apprenticeship. But we do demur to the idea that Sir J. B. Robinson, having formed a public company, has any right to run the Randfontein as if it were his private property. EDITOR].

PERSONAL

J. A. AGNEW is severing his connection with Bewick, Moreing & Co.

FERGUS ALLAN is expected from El Oro, Mexico.

ARTHUR R. ANDREW has gone to Sarawak.

SYDNEY H. BALL is here from America.

R. S. BOTSFORD is at Bogoslovsk in the Ural Mountains.

WALTER BROADBRIDGE was at the Braden mine, in Chile, during July.

J. MORROW CAMPBELL is in Norway.

T. LANE CARTER, of Chicago, is in Montana.

S. HERBERT COX, on his retirement as professor, has been awarded the honorary title of Emeritus Professor of Mining in the Royal School of Mines.

T. W. TEAGUE CURNOE is now in Nigeria.

EDWARD L. DUFOURQ is returning to America after a visit to England and Europe.

ROWLAND FEILDING is in Newfoundland.

J. H. FENNELL has returned from Hungary and will be going to New York.

W. E. GORDON FIREBRACE has gone to Russia.

DONALD F. FOSTER has sailed from West Africa.

HENRY J. GIFFORD, manager of the Champion Reef mine, is home from India.

THOMAS E. HARDY is returning to the Barranca mines, in Sonora, Mexico.

HENRY HAY has returned from California and will proceed to the Gold Coast.

C. S. HERZIG is in Bohemia.

W. A. HEYWOOD has gone to Aroa, in Venezuela, for the South American Copper Syndicate.

JAMES HOCKING, manager of the Cordoba copper mine, Spain, is taking a holiday in Cornwall.

CARL HOFFMANN has been in London from Mexico.

WALTER T. HOLBERTON has been appointed manager to the Societé Française des Mines de Cuivre de Collahuasi, in Chile.

SIR THOMAS H. HOLLAND is a member of the Admiralty Commission on Oil Fuel.

E. HOMERSHAM has resigned as manager of the Prestea mine and is succeeded by W. Crosley, recently at Chihuahua.

W. L. HONNOLD arrived here from Johannesburg on July 27.

H. C. HOOVER leaves for New York on August 17.

C. J. INDER is in Russia.

JOHN T. KEATING is in the Kano district of Northern Nigeria.

C. B. KINGSTON has arrived from Bulawayo.

NEWTON B. KNOX left for Peru on July 23.

R. B. LAMB, of Toronto, is here.

W. H. LANAGAN succeeds his chief, C. H. MUNRO, as resident manager for the Orsk Goldfields.

THOMAS H. LEGGETT has become consulting engineer to the American Smelting and Refining Company.

S. H. LORAM, of Valparaiso, is here.

FRANK C. LORING, formerly at Cobalt, but now resident at Toronto, was in London recently.

A. N. MACKAY left for Colombia on July 31.

JAMES A. MACTEAR has returned from Peru.

E. T. MCCARTHY, J. MACKINTOSH BELL, and H. C. WOOLMER have returned from Western Siberia.

ALEXANDER MCGREGOR has been appointed Geologist to the Rhodesia Museum.

WILLIAM MCNEILL has returned from Johannesburg.

W. W. MEIN is manager for the Canadian Exploration and Mining Company.

FRANK W. OLDFIELD is returning to Bolaños, in Mexico.

G. E. OWLES has left for Idaho on examination work for Bainbridge, Seymour & Co.

HERBERT POMEROY, JR., has left the Compañía Minera de Andacollo and is now at Valparaiso, Chile.

FRANK H. PROBERT sailed for New York on the *Caronia*.

C. W. PURINGTON sailed for New York on July 20th, on his way to Nome.

BEN S. REVETT is at New York.

S. A. R. SKERTCHLEY has returned from the Tampico oilfield.

O. J. STEINHART, of Twite & Steinhart, has been in Norway recently.

JOHN F. TELFER has returned from West Africa and is proceeding to California.

W. H. TREWARTHA-JAMES sailed for Nigeria on July 30.

D'ARCY WEATHERBE sailed by the *Olympic* on his way to Peru, on August 7.

FRANKLIN WHITE was here from Bulawayo, previous to sailing for Sydney, N.S.W.

L. B. WILLIAMS has been appointed manager of the Queen of the Hills mine, Meekatharra, W.A.

H. V. WINCHELL is travelling in Germany.

J. YOKOBORI, professor of metallurgy in Kyoto University, is making a journey of observation in Europe and America.

PRECIS OF TECHNOLOGY

Alumina in Copper Slags.—At the annual meeting of the Australasian Institute of Mining Engineers held at Sydney at the beginning of June, H. C. Bellinger, in his presidential address, referred to the behaviour of alumina in slags produced in copper smelting, and quoted the diverse opinions expressed by leading metallurgists as to its acid or basic action. He mentioned the case of Rossland ores in British Columbia where the gangue averaged 14 to 18% alumina, 10 to 12% lime, 2 to 3% potash and soda, and 40 to 46% silica. The first metallurgist in charge calculated the alumina as an acid, so he added limestone. The furnace froze in two hours when run on this supposition, so he came to the conclusion that the alumina was more active than he had supposed, and to rectify matters he added a larger amount of limestone, only to make matters worse. Another metallurgist was then engaged to investigate the state of affairs. He assumed that the alumina in combination with silica would continue to act as a base while the remainder would act as an acid; in this case the two would practically eliminate each other in the slag calculation. In practice it was found that this supposition was correct, and smelting has been conducted on this system with satisfactory results ever since. On the other hand, at one of the metallurgical plants at Butte where conditions demanded the formation of a slag containing 45 to 50% silica, the whole of the alumina (8%) definitely acted as a base. The author also quotes similar experience at the Northport and Britannia smelters. At Crofton, B.C., the author was engaged in smelting a copper ore containing 40 to 45% of barite and 8 to 9% zinc. On account of the low temperature of formation of the slag it was necessary to add both silica and alumina in order to make the furnaces run properly. The slag contained 5 to 12% alumina, and it was difficult to ascertain the exact role played by it. The aim was to utilize as far as possible the base units and the object therefore was to crowd as much silica on the charge as possible. All the slags resulting from the various mixtures were practicable, and ran in a highly satisfactory manner, but nevertheless the author found that in some cases the alumina acted apparently as an acid. The author also shows how the alumina behaves in different ways at different times at Great Cobar.

From the foregoing figures and extracts, it is obvious that the function of alumina remains still in a decidedly unsatisfactory state of uncertainty. From diversified experience the author concludes that we must look beyond the mere chemical analysis of the ores in order to evolve a reasonable and definite process of action for alumina. "Take, for instance, the porphyritic formations with the large influence of the felspars in evidence, and we have certain combinations for silicates of alumina and other bases. The felspars constitute an extensive list of minerals with a wide range of composition, from orthoclase with 18.4% of alumina and 16.9% of potash, to anorthite with 36.7% of alumina and 21.1% CaO. Both the felspars, physically and chemically, in their respective behaviours under similar treatment, are widely divergent. Thus, on through the various meta-silicates, ortho-silicates, to the hydro-silicates, we find the same varied conditions physically and chemically with widely different genetic laws. The range of oxygen ratios varies from less than one to one in the sub-silicates, to four to one in the bi-silicates. It is when one considers the many conditions of combination in aluminous compounds, and has noted the definite changes in the action of

the alumina in sympathy with variations in such combinations that it becomes quite feasible that, under similar furnace conditions, we could reasonably expect the compounds to adopt roles suited to their peculiar forms. Many engineers have, for instance, found, under certain conditions, that by calculating the alumina soluble in acids on the acid side and treating the insoluble alumina either as base or as an independent elementary magma they have obtained excellent results. Though Peters says that this method has no scientific foundation, it is interesting to note that it has been a success in some cases, and the reason for this success may in the future be condensed to a scientific basis."

Silver-Lead Deposits of British Columbia.—In *Economic Geology* for June, S. J. Schofield describes the silver-lead deposits of East Kootenay, British Columbia. He takes the Sullivan and St. Eugene, the two largest producers, as the types, and he compares these occurrences with those across the border in Idaho, especially the Wardner mines, the Granite, and the Tiger-Poorman. The Kootenay deposits are found as replacement orebodies in the sedimentary rocks of the Pre-Cambrian and Cambrian ages known as the Purcell series. These rocks consist of argillaceous quartzites, locally known as slates, purer quartzites, and argillites, together with minor amounts of limestone. Several small bodies of granite and granite-porphry intrude into the series. The ore-bearing formation is the Aldridge quartzite, and it is the oldest of the Purcell series. The Aldridge quartzite consists of a series of thick and thin beds, and the orebodies are confined to the upper parts where thick bedded and purer quartzites preponderate. The rock is grey on fracture and weathers to a rusty brown. At the Sullivan mine the maximum stope-width is 120 ft. and the maximum stope-length 525 ft. The interior of each ore mass consists of an intimate mixture of blende and galena, with smaller amounts of the iron sulphides, pyrite and pyrrhotite, and jamesonite. Here and there are found lenses of purer galena. The gangue is small in amount, and contains idiomorphic crystals of pink garnet, some diopside and actinolite, and subordinate quantities of calcite. This interior zone passes outward into a fine grained mixture of pyrite, pyrrhotite, and small amounts of galena, associated with crystals of colourless garnet, actinolite, and mica. This pyritic zone gradually changes into a cherty zone, which is only present however where the country rock is the heavy-bedded purer quartzite. The chert contains none of the gangue minerals mentioned above. As already mentioned, the ore deposit is a conformable replacement. This replacement is well shown by the alternate banding of ore and quartzite near the periphery of the ore masses, where the relative susceptibility to replacement of the laminae of the quartzite varied. Joining these favourable bands are numerous interlacing veinlets of sulphides which represent an intermediate stage in the complete replacement of the quartzite. Examined microscopically, the sulphides appear to have entered between the quartz grains of the quartzite, and then to have attacked the quartz itself. The sulphides entering along the favourable laminae have replaced the muscovite also; evidently the muscovite has been formed previously to the introduction of the sulphides. A paragenetic study of the ores shows that the gangue minerals are often in idiomorphic crystals and free from sulphides. Also the small cracks in the gangue minerals are filled with a mixture of pyrite, pyrrhotite, blende, and galena. From these facts it is concluded that the gangue minerals were formed first. The relative period of

formation of the gangue minerals cannot be ascertained, as they have never been seen in contact. There is a possibility that some of the sulphides are contemporaneous with the gangue minerals, for idiomorphic crystals of pyrite and arsenopyrite have been found embedded in the fine-grained sulphides. This second generation of the sulphides is represented by a fine-grained intimate mixture of galena, blende, pyrite, and pyrrhotite, the order of formation of which is so confused that they may be taken to be contemporaneous. The sulpho-salt jamesonite is associated with small calcite veins which are later than the main ore-bodies, and it is probably a secondary mineral. The passage for the ore solution which formed the Sullivan deposit is believed to be the well-defined bedding-planes of the quartzitic strata. From several such channels the solutions replaced the country-rock within their sphere of influence. The presence of the minerals, garnet, diopside, actinolite and muscovite, which are entirely restricted to the ore deposit and absent from the surrounding quartzites, suggests that the deposition of the ore took place in the deeper vein zone, under conditions of temperature and pressure comparable to those of contact metamorphic deposits. No igneous intrusion that could supply solutions of this kind outcrops within several miles of either the Sullivan or St. Eugene deposits. However, in the neighbourhood of the Sullivan, small sills of gabbro older than the ore deposit are exposed, and in the St. Eugene, a dike of diorite cuts the deposit. The areal study of the East Kootenay district revealed numerous cross-cutting bodies of granite and granite-porphry which are probably subordinate or 'cupola' stocks of the West Kootenay granite batholith. In addition, the areas of mica schist in East Kootenay are interpreted as argillaceous quartzites metamorphosed by an intrusion of granite not yet exposed by erosion. It is therefore concluded that the Purcell series in part rests upon an intrusive basement of granite which was the source of the ore solution. The conditions of formation at St. Eugene were less extreme than those of the Sullivan, and comparison with the Idaho deposits points to their being formed on still less extreme conditions.

Preservation of Mine Timbers.—A bulletin (107) with this title has been published by the Forest Service section of the United States Department of Agriculture. It is written by E. W. Peters and contains a large amount of information as to the prevention of decay of mine timbers, the methods of treatment by preservatives, and the cost thereof. Starting from first principles, Mr. Peters shows that green timber should be stripped of bark, for not only do the crevices between the bark and the wood harbour insects, but the bark checks the evaporation of moisture from the green wood and so encourages the growth of fungus. Moreover the bark may subsequently peel off and fall in the workings, thus causing an accumulation of inflammable rubbish. As regards ordinary seasoning of timbers by piling in a dry place and arranged with a view to full ventilation, Mr. Peters is only in its favour when the timber is to be used in dry well-ventilated mines, for otherwise the effects of seasoning are soon counteracted by the re-absorption of moisture. He notes that timber cut in summer is likely to deteriorate during seasoning, and recommends that cutting should be done at other times in the year.

The author then proceeds to describe chemical preservative methods. The timber should be stripped of bark and preferably seasoned. It should be first cut to the shape required, otherwise sawing will expose untreated portions. A cheap way of treatment is to

give with a brush two or three coats of hot creosote. This must be done carefully so that all cracks and crevices are filled, but even then the coating does not act efficiently for any long period. The next best method is immersion in an open tank. Here the timbers are heated to a sufficiently high temperature to expel some of the air and moisture contained in the wood. It is necessary to carefully regulate the temperature so as to prevent undue volatilization of the creosote or damage to the wood. The maximum temperature for creosote is 220°F, and with aqueous salt solutions the temperature should be kept just below the boiling point. Following the hot bath, the timbers are immersed in preservative at a lower temperature. This method of treatment is fairly well adapted for woods that are easily impregnated.

With many of the best woods a satisfactory treatment can only be secured by the use of pressure. Either creosote or zinc chloride may be used. The timbers are placed in a long cylinder 40 to 60 ft. long and 5 or 6 ft. in diameter, the preservative is pumped in, and air pressure applied at 100 lb. per sq. in. or over. Two charges can be treated per day. At Anaconda the treating cylinder is 43 ft. long and 6 ft. diameter, and its capacity is about 570 cubic feet of timber. The absorption of creosote is $4\frac{1}{2}$ lb. per cubic foot. The first cost of the necessary plant was \$15,000. The cost of treatment of a shaft-set containing 1127 ft. of timbers and 393 ft. of lagging was \$12 60, of which \$8 03 was the cost of creosote at 15 6 cents per gallon. The cost of the set untreated was \$45 61, and the cost of fixing in place was \$18 00, bringing the total cost of the set in place to \$76 21.

Reinforcing Timbers with Wire-Rope.—In his yearly report on the Scotland district, the Government Inspector of Mines, W. Walker, describes a method adopted at one of the coal mines in Lanark for strengthening roof timbers. The depth of the working is shallow, varying from 24 to 84 ft. below the surface. The stratum forming the roof is mostly boulder clay and is wet and treacherous, so that the life of the timbers was not more than six months. The manager three years ago adopted a method used in Silesia and no renewals have been required since. This consists of strengthening the roof supports by fixing a piece of wire rope along the under side. In preparing the timbers at surface, the rope is fixed by staples in a groove, and one end of the rope is turned round the end of the timber and fixed there as well. The completion of the other end is done below, when the exact length required has been ascertained. The method involves little extra expense, as there are always odd lengths of old wire-rope at a mine. Care must be taken however to choose perfect pieces, as any loose strand would do damage.

Ferro-concrete Shaft-linings.—The *Iron & Coal Trades Review* for July 5 contains an article by C. Meuskens describing the methods adopted by W. Breil for lining shafts with ferro-concrete. These methods are in use at several coal-mines in Germany. The first method is shown in Fig. 1 to 4, and is applicable as a substitute for the ordinary process of building the lining from the bottom. Each facing-block is about 2 ft. square, with the necessary curve, 2 to 3 in. thick, and having end flanges 8 to 12 in. deep. Iron reinforcements are inserted in the position shown in Fig. 1 to take up tension strains caused by rock pressure exercised before the mortar backing is dry. Tight joints between individual blocks in the same row are secured by filling the vertical grooves (n) Fig. 2 with mortar, and between horizontal rows by the step (V) Fig. 3. Around the back of the blocks, and supported

in grooves (*n*) Fig. 3 of the flanges, are a series of horizontal iron rods (*feh*), Figs. 3 and 4, and at intervals between there are vertical rods (*fev*). The horizontal rods are tightened by the screws (*S*). As the lining is built, the space between the rock and the

segments in 7 or 10 ft. lengths. Several complete rings of these are attached, to the height of 5 ft. or so, and the whole wedged tightly. The horizontal lattice rings, which may be 10 to 20 in. apart, and the vertical ties, form open panels, and wire screens are

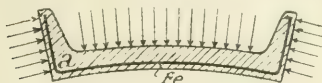


Fig. 1.

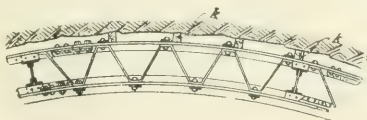


Fig. 5.

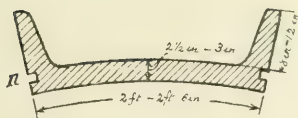


Fig. 2.

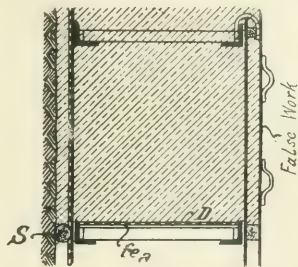


Fig. 6.

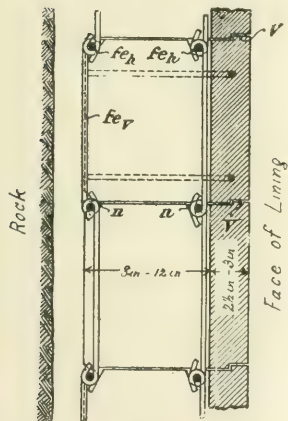


Fig. 3.

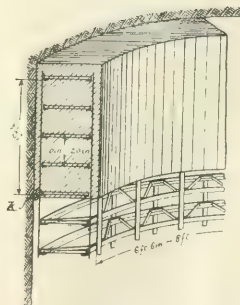


Fig. 7.

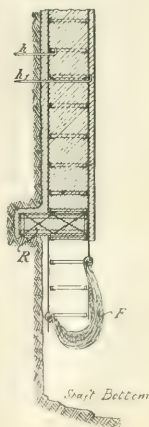


Fig. 8.



Fig. 4.

BRIEL'S SYSTEM OF LINING SHAFTS WITH FERRO-CONCRETE.

blocks is filled with mortar or concrete and rammed tight.

The other method invented by Briel consists of an application of ferro-concrete to the method of shaft-lining by suspended tubing. As shown in Figures 5 to 8, the iron reinforcements consist of lattice-girder

placed over the outer surface to prevent rock falling inward. In filling the mortar and concrete, false iron-work is fixed so as to surround the lattice girders on the inner side, and netting (*D*) is fixed at the bottom. The mortar squeezes through the netting and forms a rough surface for the concrete of the next ring below.

The Churn Drill in Shaft-Sinking.—In the *Mining and Scientific Press* for July 13, Tom McCormac describes the application of the churn drill in shaft-sinking. Churn-drilling has long been practiced, and is the commonest method of drilling any soft rock, particularly in surface work. In these latter days of the almost universal use of compressed-air drills, the author considers that churn-drilling has not been used with the frequency that is justified by the results which can be obtained from its use. In hard rock the method cannot compete with the power-driven drill, but in shaft-work excellent results have been obtained in the softer rocks. Chief among the advantages of churn-drilling is the fact that in any ordinary shaft drilling can be started within ten minutes after the broken rock from the previous round has been removed. The hole drilled, furthermore, is large, and, when loaded, the powder lies well toward the bottom, where it can do the best work. In speed it is even the faster in some cases than the air-drill, as no time is consumed in the unproductive work of 'setting up' and 'tearing down.' It has the further advantage of requiring no expense for power. Though no particular skill is required in its operation, still the hard work involved in its use makes a careful selection of the drilling crew imperative. A good active workman will accomplish twice as much drilling as a man only a little less energetic; while in the hands of poor men, churn-drilling would probably fail entirely.

The author is indebted to W. H. Storms' 'Timbering and Mining' for several of the ideas which he used in sinking a two-compartment shaft through a firm but soft shale; but he was first induced to try the drills by Martin Empey, a miner at Ely, Nevada. In this shaft it was the usual routine for four men to drill 10 holes from 4 to 5 feet deep, and blast in four hours. No piston-drill could compete with the churn-drill in this class of rock. He used the common $\frac{3}{4}$ -in. drill steel sharpened at each end and in 7 and 9-ft. lengths. Should deeper holes be desired, the use of bits fitted for 1-in. pipe is recommended; these can be attached to a pipe of any convenient length. The shape of the bit is of more importance than in hand drilling, and it should be carefully made, rather strongly forged, exactly gauged, and tempered very low. A churn-drill is not intended for hard rock, and a low temper, almost a blue, will give the best results.

Usually a hole was started with a hammer and drill, although there were times when the rock was soft enough to auger a short distance. Until a hole reaches a depth of a foot or 18 in., the drilling goes rather slowly; after that it goes surprisingly fast. Up to a depth of three feet the hole can be cleaned if necessary with an ordinary machine 'spoon,' but a deeper hole can be more quickly cleaned with the device described by Mr. Storms, a bar of $\frac{3}{4}$ -in. iron with an eye welded in the end through which can be drawn an old rope yarn or a piece of rag. This, dropped into the bottom of the hole, is withdrawn and wrung out, and the operation repeated until the hole is dry. Should there be too much water, it can be removed by using a piece of $\frac{3}{4}$ -in. pipe bent over at the top and using one hand at the top for the valve, or it can be removed by using the sand-pump. A simple form of the latter is a pipe having the bottom drawn to a small opening which is closed with a steel ball, held from being thrown out of the pipe by a pin a short distance above. Plenty of old sacks for 'mop rags' are needed, and a couple of tin cans, without bottoms, will occasionally be found useful for casing the top of a large hole.

One of the most frequent causes of trouble in drill-

ing with the churn-drill is the encountering of caving or raveling ground. In such case the supply of drilling water must be kept as low as possible, in the hope that the thick mud will plaster the sides of the holes. If a drill should break, it can usually be loosened in the hole and fished out with the scraper, or it can sometimes be made to adhere to a lump of mud or clay on the end of the loading stick or scraper. The bar magnet, suggested for this work, would prove too interesting a plaything to be permitted in a shaft.

Effect of Arsenates in Cyanidation.—At the April meeting of the Chemical, Metallurgical, and Mining Society of South Africa, Andrew F. Crosse presented a paper commenting on the effects of mineral sulphates and arsenates on cyanide operations. We extract his remarks on the effect of the presence in ores of scorodite, or ferric arsenate, $\text{FeAsO}_4 + 2\text{H}_2\text{O}$. This mineral often occurs with limonite, and the two are probably the result of the oxidation of arsenical pyrite. Scorodite is insoluble in water, but soluble in weak hydrochloric acid and in aqueous sulphurous acid. When a finely ground ore or rock containing scorodite is left in contact with a weak caustic soda solution, sodium arsenate is slowly formed. Sodium and potassium cyanides have a similar effect, and this accounts for the slow continuous decomposition of cyanide solutions when the ore contains arsenates. The solutions become charged with arsenates, which are reduced in the zinc-boxes. The precipitated gold carries arsenic, and much inconvenience is experienced in the subsequent sulphuric acid treatment owing to arseniuretted hydrogen being liberated. Mr. Crosse has made experiments with a view to removing the dissolved arsenic, and he found that if hydrated lime is added to the solution containing sodium arsenate the arsenic is precipitated as insoluble arsenate of lime, and the sodium hydrate regenerated. He therefore adds a small amount of sodium hydrate and an excess of hydrated lime in the treatment of ores containing arsenate. In one sample of ore containing scorodite, it was found that 13 lb. of sodium hydrate was required per ton of ore, and by regulating the lime, sufficient was left for the settlement of the slime.

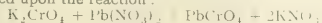
Ammonium Sulphate.—Hitherto it has been impossible to produce ammonium sulphate direct from the gases evolved in the carbonization of coal, either in illuminating-gas retorts or in coke ovens. It is well known that these gases contain large amounts of ammonia and sulphuretted hydrogen. These are removed in separate apparatus. The sulphuretted hydrogen is caught by iron oxide with the formation of sulphide, which is sent to the sulphuric acid plant, and the sulphuric acid there produced is used for extracting the ammonia as sulphate. Chemists have long looked for a more direct process that would eliminate sulphuric acid manufacture. Walther Feld, in *Metallurgical and Chemical Engineering* for July, describes his direct process that has been working satisfactorily at Koenigsberg in Germany for over a year. This is known as the polythionate process, owing to this group of salts of ammonia being used as absorber of the sulphuretted hydrogen and ammonia. The process starts with the production of polythionate from thiosulphate by treating with sulphurous acid made by the burning of sulphur. The polythionate solution is passed through the gas scrubber where it absorbs the ammonia and sulphuretted hydrogen, resulting in the production of ammonium thiosulphate. This is returned to a regenerator to be reduced to thiosulphate again by sulphurous acid, and the liquor is circulated between the scrubber and the regenerator until the amount of polythionate has increased to a certain

specified amount. Part of the liquor is then withdrawn and sent to a vessel where it is heated with steam, the result being the production of ammonium sulphate and free sulphur. It will be seen that the only substance introduced into the cycle of operations is the oxygen of the air used in burning the sulphur.

Subsidence-Shocks on the Rand.—In his address to the South African Institute of Engineers in June, R. N. Kotze discussed the question of subsidence in mines, recommending the general introduction of the practice of packing exhausted stopes as soon as possible. His remarks on the shocks experienced on the Rand were of interest. These shocks consist of a single wave or vibration, and are accompanied by a dull thud such as made by a heavy body falling upon the ground. There are no doubt due to undermining and in several cases the shock has been known to occur at the time some subsidence has taken place. The single vibration differentiates it from an earthquake, which consists of a series of waves. The origin of a shock is to be sought, not in the fall of hanging wall, but in a slight and sudden subsidence of an enormous mass of ground weighing millions of tons either along a fault-plane or over pillars. In the latter case the weight is usually unequally distributed and is specially heavy on some of the pillars. These collapse or punch into the foot-wall, and the release of strain causes the shock. The phenomenon is similar to the result of crushing a rock or other solid in a testing machine. Some of the occurrences known as air-blasts probably have a similar origin, though Mr. Kotze is of opinion that most of them may be accounted for by a comparison with the behaviour of rapidly cooled glass known as Rupert's drops. The weight at great depths and the tectonic pressure that has caused the tilting, folding, and faulting of the strata have induced a condition of strain in the rock at certain places similar to that in the drops. Thus when a free surface is exposed in mining, the mass has a tendency to crack and disrupst suddenly. Small pieces are often projected great distances, and even large masses are occasionally dislodged.

Estimation of Lead in Smelter Gases.—The Annual Report for 1911 on Alkali Works contains information about the improved method of estimating lead and its application to smelter fume, devised by Linder and Ballard.

It is usual to determine lead volumetrically by the chromate method. This consists in precipitating the lead as chromate and determining the chromic acid volumetrically by standard ferrous solution, or by means of potassium iodide. The chromate method is based upon the reaction:



The reaction only proceeds normally when the chromate is in excess. If during the reaction lead is in excess and hot liquors are used, then the precipitate will carry more lead than the formula PbCrO_4 warrants, and the excess will vary within rather wide limits according to the manner of working. Direct titration of a lead solution is, therefore, inadmissible. An indirect method of titration has been devised by the authors which appears to work well, and which has the advantage of dispensing with the use of standard solutions that change on keeping. The procedure is as follows:

A measured volume, in excess, of the standard chromate is added to the lead solution and the titration is completed with standard lead nitrate solution, using silver nitrate as indicator. Chromate is thus kept in excess until the completion of the titration, and the reaction of the liquid with the indicator yields

a colour which diminishes in intensity progressively as the titration proceeds.

Method of Titration of Lead Solution:

Standard lead solution, 8 grammes $\text{Pb}(\text{NO}_3)_2$ per litre.

1 c.c. = approx. 0.005 gramme Pb.

Standard potassium chromate, N/50 strength.

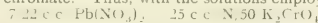
Acetate of sodium, nearly saturated solution, to which is added 40 c.c. glacial acetic acid per litre.

To Standardize the Solutions:

Add to 50 c.c. of water, 5 c.c. of acetate solution and 5 c.c. of $\text{Pb}(\text{NO}_3)_2$ solution heated to about 80°C ., 25 c.c. of N/50 K_2CrO_4 with stirring; now add to the solution 0.5 to 1 gramme of precipitated calcium carbonate, heat to boiling, and run in $\text{Pb}(\text{NO}_3)_2$ solution from a burette, until a drop of the supernatant liquor drawn from near the surface by a tube with capillary end gives no perceptible colour change with a drop of N/10 AgNO_3 . The progress of the titration can thus be watched to the finish, and at the end it is found convenient to place two drops of the supernatant liquor side by side on a tile, to add silver nitrate to one and compare the tints. The temperature of the solution at the close will be about 40°C . Dilution to 160 c.c. does not affect the result, but 85 to 90 c.c. is the volume most suitable for the test.

The calcium carbonate should be 'purissimum, precipitated by ammonia'; the ordinary 'pure' is useless as it floats on the surface.

By this means we determine the lead equivalent of the chromate. Thus, with the solutions employed:



Titration of Lead Solution under Examination:

Add to the lead solution (50 c.c.) containing 5 c.c. of acetate solution, 25 c.c. of N/50 K_2CrO_4 . If in excess, proceed as above; if insufficient to leave excess of chromate, add a further 25 c.c., followed by calcium carbonate, etc. Now run in $\text{Pb}(\text{NO}_3)_2$ solution slowly from the burette until the excess of chromate is exactly precipitated. Deduct the number of c.c. required from the standard figure 7.22 (or 2 by 7.22); the difference will be the equivalent of the lead in the solution taken.

Copper and zinc do not appear to interfere with the end-point if present in small amount, but the method is inaccurate in presence of arsenic and iron. Removal of arsenic is a troublesome matter, if other than traces are present. Joint precipitation of the sulphides and extraction of the arsenic sulphide by means of sodium sulphide proved to be an unsatisfactory method. The most convenient procedure was found to be the following:

The solution should be evaporated with excess of sulphuric acid and gently heated to fuming point to expel nitric acid; the residue is then diluted to 10 c.c., heated to boiling point, and diluted with twice its volume of 90 per cent. alcohol. The solution, after stirring well, is allowed to stand for 10 to 15 minutes, and is then decanted through a small filter paper, the precipitate being retained as far as practicable in the dish. The precipitate is washed two or three times with 50 per cent. alcohol and once with 90 per cent. alcohol, and the dish, with contained sulphate, is then dried on a water bath. The filter paper is separately dried on a glass plate and the traces of sulphate retained thereby returned to the dish; the paper is then warmed on the plate with 5 c.c. of acetate solution and the extract added to the dish and the paper further washed with water. The solution in the dish is now heated to dissolve the lead sulphate and the solution diluted to 50 c.c. and titrated as above.

If the amount of arsenic is excessive, it is necessary to dissolve the lead sulphate in the dish, after washing once with 50 per cent. alcohol, with 5 c.c. of pure normal caustic soda solution with the aid of heat and to reprecipitate the lead sulphate by addition of sulphuric acid followed by addition of alcohol, etc., as described above.

If the amount of lead exceeds the equivalent of 50 c.c. N/50 chromate, the final solution should be diluted to a measured volume, and an aliquot portion taken for analysis with addition of sufficient sodium acetate solution to bring the total volume present in the titration to 5 c.c.

The application of this method to smelter gases, described by the authors, supposes that arsenic is absent.

About 250 c.c. of distilled water is taken in the bellows aspirator with addition of 7 c.c. of 10-vol. hydrogen peroxide. After aspirating a given volume of the gases the tube employed in the test is carefully washed and any adhering particles of lead fume removed by cleaning the tube with the aid of a small tuft of cotton wool. The solution is now titrated with standard alkali for estimation of total acidity in the usual way. To the contents of the dish is added 2 grammes of magnesium sulphate, followed by a small excess of sodium carbonate solution, and the whole heated, stirred, and filtered through a small paper. This occupies but a few minutes. The magnesium carbonate precipitated in the solution assists in the collection of the lead precipitate, which might otherwise pass through the filter. The filtrate should be quite free from lead. The paper is dried and carefully burnt off at a low temperature and the ash warmed with a little strong nitric acid, and a drop or two of sulphuric acid to oxidize any sulphide present. A little water is added and the solution neutralized with sodium carbonate. 5 c.c. of the acetate solution are then added and the whole boiled to dissolve the lead sulphate. The volume is then diluted to about 80 c.c. and the lead determined by the chromate method described above.

As an alternative method of bringing lead fume into solution the following procedure is proposed: The residue on the dried filter paper is cautiously incinerated and the ash fused in a porcelain crucible over a Bunsen burner for 3 to 5 minutes with about 0.7 gramme of sodium sulphate and 2 grammes of potassium nitrate. The sulphides are thereby oxidized to sulphates and carbonaceous matter destroyed. The residue is then brought into solution by means of sodium acetate solution in the manner described above.

It is important to remember that the lead equivalent of the chromate solution used in the experiment should be determined under the same conditions as those in the analysis; dilution, amount of sodium acetate or other salts present, and temperature should be approximately the same.

Artificial Rubies.—In our issue of June 1911 we gave an abstract of a paper by Noel Heaton describing the method of making artificial rubies and sapphires by fusing alumina in the oxy-hydrogen blowpipe. It was stated then that the difficulty of differentiating between such a product and the natural stone was great. The Burma Ruby Mines company, the largest producer of the real article, commissioned Mr. Heaton to tabulate the points of difference. This chart is now being circulated by the company. The differences relate to variations of colour, included bubbles, striations, inclusion of foreign matter, and 'silk.' As regards colour, the natural stone often exhibits variations in different parts, the bands being either parallel

or irregular; whereas in the artificial stone the colour is generally uniform, but when varied the bands are curved in outline. The bubbles contained in the natural stone are irregular in shape, often elongated and frequently angular; in the artificial stone they are generally perfectly round, rarely elongated, and never angular. Striations in the natural stone are perfectly straight or rectangular in outline; in the artificial stone they consist of a series of concentric curves. Inclusions of foreign matter in the natural stone consist of particles of various sizes arranged in an irregular manner; in the artificial stone they are small particles generally arranged on curves following the lines of striation. As regards 'silk,' this is a characteristic of the real ruby never reproduced in the artificial stone; it is due to a series of minute parallel canals arranged in three definite directions, giving a silky sheen by reflected light. The chart gives a number of beautiful coloured illustrations based on microphotographs.

Dry Concentration of Placer Gold.—In the *Mining and Scientific Press* for July 13, F. J. H. Merrill reviews the various types of machines used in the arid regions of Western America and Mexico for recovering gold from placer deposits. After mentioning the batea, he proceeds to describe the common Mexican 'dry washer' which is said to have been introduced by Hungarians about 1850 and extensively used in northern Mexico. This consists mainly of a tray about 1½ by 3 ft., with muslin bottom and 5 cross-rifles resting at an inclination of about 15° on a frame, beneath which is a canvas bellows. The latter forces through the muslin an intermittent blast of air which drives away most of the fine light material. The gravel is fed through a hopper upon the upper end of the tray and is moved slowly down the slope by the jar of the bellows stroke. As the operation proceeds, the gold lodges on the riffles, chiefly behind the two uppermost, and the material of lower specific gravity flows on over the riffles and gradually passes out of the machine at the lower end. The slope of the latter is increased, when necessary, by elevating the rear legs, and an inclination of 25° is frequently used.

An improved type of this machine was put on the market some eight years ago by Sutton, Steele & Steele, of Dallas, Texas. In this the stationary tray is replaced by a revolving table or belt about 3 ft. wide, with riffles about 8 in. apart and screened with muslin. This is inclined about 30°, the slope being adjustable. The operation of this machine is identical with that of the Mexican 'dry washer,' except that the operation is continuous, and as the fine is driven away by the intermittent bellows blast which passes through the muslin, the riffled belt raises the concentrate to the top of the machine and, passing over, dumps it into a box at the rear. A difficulty, however, is a lack of durability and a tendency to get out of adjustment, which made it necessary at frequent intervals to stop work for repairs. If this machine were perfected, as it undoubtedly can be, it would be most valuable.

The Curtis machine, made in Denver, uses a continuous blast of air from a fan. As usually constructed, each unit consists of a trough-like box, semicircular in vertical section and covered by a perforated plate, somewhat less than an inch thick. The perforations are semicircular in cross-section and about an inch in diameter. They are partly closed beneath by wire gauze, which allows the air-blast to pass but retains the concentrate. The boxes, which are usually set in pairs on a frame, have a gentle inclination and receive lateral agitation from a cam. The gravel is fed upon the upper end of the plate and, as it passes

down the slope, the fine material is blown away and the concentrate is caught in the holes or recesses which serve as riffles, the tailing escaping at the end. To clean up, the machine is stopped and the plate is rotated on a longitudinal axis, dumping the concentrate into the trough below, from which it is removed. The machine has made good recoveries on some material, but requires closer sizing than one-eighth inch.

Another type is the Shumway concentrator, made in Los Angeles. This consists of a shallow wooden box, covered with thin canvas through which a continuous air-blast is forced by a fan. Over the canvas, wire netting of about half-inch mesh is laid. By means of cams the box, which is slightly inclined, is agitated laterally and the gravel fed upon the canvas at the top of the incline, passes down the slope, leaving the concentrate in the meshes of the wire, while the tailing falls to the ground. To recover the concentrate, the operation of this machine must be suspended and the table tilted for cleaning up. It has done good work under favourable conditions, but it also requires finer sizing than one-eighth inch.

The Jardine concentrator, made in San Francisco, is the result of a diligent effort to construct a durable machine which is continuous in operation and does not stop for cleaning up. The air-blast comes from a fan, but is made intermittent by a rotary valve. The shallow box which serves as an air-chamber is interrupted across its length by riffles of parallel metal plates with intervening slits which guide the concentrate down into cylinders in which worm conveyors rotate, conducting the gold and heavier materials to a trough at one side. Between the riffles, the surface of the table is formed of a cotton-cloth screen, through which the air-blast passes. Lateral agitation is provided and as the gravel passes down the sloping table, the fine light material is blown away. The concentrate caught by the riffles is delivered into the trough at the side, and the tailing passes away at the end of the table.

A machine of much efficiency has recently been devised by A. H. Stebbins, of Los Angeles. This, in general form and action, resembles closely a Wilfley table. The surface and the riffles are formed from sheet metal, the latter being about 1 in. apart. Air is introduced beneath the table in a continuous blast from a fan, and reaches the bed of gravel through minute perforations in the metal surface of the table. These perforations, which are as close together as possible, are rectangular and about $\frac{1}{4}$ in. long and 0.025 to 0.015 in. wide. The longer axes of these slits stand at about 45° to the direction of the riffles. The form of the slit gives the air-jet an inclination of about 10° above the surface of the table, and the air-sheet formed by these jets flows with the gravel in its descent along the slope. It is stated by the inventor that material as coarse as $\frac{1}{2}$ in. can be treated on this machine, which apparently is destined to be quite successful.

Primarily the gravel treated must be dry. Average uncemented placer gravel as it occurs, even in the dry climate of Sonora, is usually too moist, when mined, for immediate treatment. The workers dry it by spreading it in the sun. To do this on a large scale would invite theft. In many cases it is necessary to provide mechanical drying, but this involves no serious difficulty in labour or expense. Cemented gravel usually carries less water than that which is uncemented, but it requires crushing and screening to bring it into the required condition for treatment. The heat generated in the pulverizer serves to remove the small amount of moisture present.

The gold in the cemented placer gravels does not occur within the pebbles, boulders, and rock fragments, but on their surfaces, being practically all included in the calcareous cement that unites them. The first step in treatment must, therefore, be the separation of the barren rock fragments from the gold-bearing cement and the pulverizing of the latter. This is done with great efficiency by the Quenner pulverizer, which consists of a revolving trommel or barrel of steel staves with a shaft rotating independently within and carrying chain hammers. These hammers effectively break the calcareous cement and leave the cobble-stones and pebbles with nearly clean surfaces, to be ejected at one end of the barrel, while the pulverized cement escapes through the quarter-inch spaces between the staves. Thus in many localities the material subjected to dry concentration for the recovery of the gold is only about one-half of the total mined. Credit for the invention of this machine is claimed by Joseph Lusignan, a French Canadian living in Nogales, Arizona, and a man of much mechanical ingenuity and skill, but Mitts Quenner, a Sonora miner, exploited the machine commercially and profited by his business shrewdness.

CURRENT LITERATURE.

First Impressions of the Rand.—In the *Mining and Scientific Press* for June 29, Edgar A. Collins writes of his recent visit to the Rand, describing the climatic and labour conditions, the status of the engineer and white worker, etc.

Placer Pay-Streaks.—At the May meeting of the Institution of Mining and Metallurgy, J. B. Tyrell presented a paper entitled 'The Law of the Pay-Streak in Placer Deposits.'

Conveying Workmen Underground.—The Official Yearly Report on the Yorkshire and North Midland District for 1911 by the late W. H. Pickering contains descriptions of carriages for conveying men from the shaft to the working face. At many collieries in England these distances are 1 to 2 miles, and with an 8-hour day in force, it has become necessary to provide further facilities for the men in covering the ground.

Veta Colorada, Parral.—In the *Mining and Scientific Press* for July 6 and 13, Bernard Macdonald described the metallurgical plant at the Veta Colorada silver mine, Parral, Chihuahua. At this mine the 'Parral' vat is in use; this was described in our issue of January last.

Parks Electro-Cyanide Process.—The *Columbia School of Mines Quarterly* for July contains an article by John R. Parks describing his electro-cyanide-amalgamation pan for extracting gold and silver from refractory ores.

Zinc in Japan.—In the *Mining and Scientific Press* for June 29, T. Inouye describes the zinc mining operations of the Mitsui company, in Japan. The ore is dressed in jigs, wilfleys, and buddles, lead and zinc concentrates being thus obtained, together with zinc middlings from each. These middlings are sent to flotation plant which is based on the modern Potter process, that is, using hot acid and a small amount of heavy oil. The zinc content is thereby raised from 20 to 45%, and the final tailing assays 5 to 6 per cent.

Electric Smelting of Zinc Ore.—The *Transactions of the Canadian Mining Institute*, 1912, Part 1, contains a paper by W. R. Ingalls reviewing various processes adopted or proposed for smelting zinc ores electrically.

Lead Poisoning.—In the *Mining and Scientific Press* for July 6, James O. Clifford writes of lead

poisoning, its symptoms and prevention, and gives particulars of Government regulations in England, France, and Germany, urging that similar steps should be taken in America.

Kyshtim Smelter.—In the *Engineering and Mining Journal* for June 22, E. J. Carlyle describes the copper-smelting plant that was started at the beginning of 1911 for the purpose of smelting the copper ores at Kyshtim in the Ural mountains.

Graphite Mining.—The *Engineering and Mining Journal* for July 20 contains a description by H. M. Beattie of the concentrating plant at Byers, Pennsylvania, for recovering graphite from quartzite and gneiss rocks.

Ferro-Silicon.—*Revue de Metallurgie* for May contains a paper on the manufacture of high-grade ferro-silicon in the electric furnace, by W. Pick and W. Conrad.

Water in Oil Wells.—In *Western Engineering* for May, W. H. Storms and P. W. Prutzman describe the present condition of Californian oil wells with regard to the large amount of water that comes up, and give details of various methods of sealing the wells against the entry of the water.

BOOKS REVIEWED

THE EXAMINATION OF PROSPECTS.—By C. Godfrey Gunther. Leather, octavo, 220 pages, illustrated. New York: McGraw-Hill Book Co. Price 8s. 6d. For sale by *The Mining Magazine*.

The sub-title of this book is 'A Mining Geology,' and serves to indicate its scope and object. The author truly says that in the United States the virgin outcrops have probably all been discovered by now, and that the prospector must in future depend on his ability to apply inductive and deductive reasoning to such surface indications as come to his notice. He has therefore presented in a convenient form the main outlines of economic geology. He is not one of the masters of the science, but his book shows him to be an able student; and it often happens that a book by such an author is of more use to the beginner and to those who have not been favoured by a specialized education than some of the more erudite and classical publications. Moreover, we welcome any book the object of which is to draw the serious attention of the prospector to the help and aid offered by science; for we still believe in the value of scientific examinations and investigations in spite of the recent violent onslaught on the work of the United States Geological Survey by an eminent geologist who ought to know better. For ourselves, we regret that the author has not treated the theories of the origin of ore deposits, for many of the discoveries made by scientific geologists have been based on these theories. But perhaps the author has desired not to antagonize the so-called practical man by introducing too much theory. The writers and examples quoted in the book are almost entirely American, a fact which will restrict its sale outside the United States. E. W.

IN SOUTH CENTRAL AFRICA.—By J. M. Moubay. Cloth octavo, 215 pages, with many illustrations. London: Constable & Co. Price 10s. 6d. For sale by *The Mining Magazine*.

This is a type of book to which we should like to be treated by mining engineers stationed in distant corners of the earth, for those whose duties take them to such places want more information relating to manners, customs, and conditions of life than the ordinary guidebook ever gives. The author spent

six years in northwestern Rhodesia and he gives a graphic account of the country, the natives, and the mines. The climate, nature of the country, native customs, and big game hunting are all described in an interesting way. Those who are going to Central Africa will find the book of interest and value.

THE DESIGN OF MINE STRUCTURES.—By Milo S. Ketchum. Cloth octavo, 460 pages, with many illustrations. New York: McGraw-Hill Book Co. Price 17s. For sale by *The Mining Magazine*.

This book is one of a series on constructional work written by the professor of civil engineering in the University of Colorado. It relates chiefly to the design of head-frames and coal tipples, and includes shorter notices of the construction of mill buildings, bins, and retaining walls, which are treated in greater detail in separate volumes. The point of view is entirely that of the civil or constructional engineer who may be called upon to design this class of structure. It pre-supposes the possession on the part of the reader of a general knowledge of applied mechanics and statics. A large number of working drawings are given of structures erected by one or two of the leading firms in the United States that make a specialty of this class of work.

INTRODUCTION TO THE STUDY OF MINERALS. By Austin Flint Rogers. Small octavo, flexible leather, 520 pages, illustrated. New York: McGraw-Hill Book Co. Price 15s. For sale by *The Mining Magazine*.

This book is called a combined text-book and pocket manual, and is written by the associate professor of mineralogy at the Stanford University, California. It is intended to cover a one-year course in mineralogy.

MINERAL OIL TESTING.—By James A. Hicks. Small octavo, cloth, 75 pages, illustrated. London: Charles Griffin & Co. Price 2s. 6d. For sale by *The Mining Magazine*.

This book was originally published in 1906, and had a ready sale. The new edition contains some additional matter. The various chapters describe the laboratory methods of ascertaining the specific gravity, flashing point, viscosity, colour, etc., of various mineral oils and products.

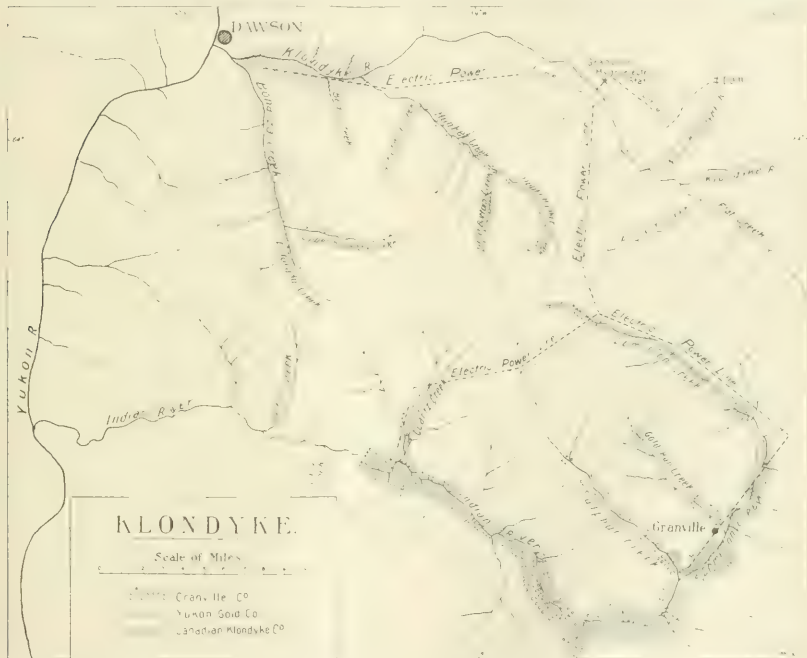
MODERN COPPER SMELTING.—By Donald A. Levy. Cloth octavo, 260 pages, illustrated. London: Charles Griffin & Co. Price 10s. 6d. For sale by *The Mining Magazine*.

No doubt the choice of a title for a book is a difficult matter, but there will be a general consensus of opinion that an error has been committed by the author of this book in using the name of one of the classics in technical literature. It is not too much to say also that the author is indebted to Dr. Peters for no unimportant proportion of the contents of his book. Candidly we do not see that Mr. Levy's book can be intended for circulation among the public, though it presumably has its uses as a text-book for his classes in metallurgy in the Birmingham University. Like so many other compilations, it is dotted with inaccuracies of detail. We expect a man thoroughly conversant with copper to be able to give correctly the names of such people as Richard Pearce, John Hollway, Charles F. Shelby, Klepetko, and Herreshoff; and to know the copper minerals so well that he does not write "pyrhotite," omit chrysocolla from the list of ores, and fail to record the importance of chalcocite in 'disseminated coppers.' This kind of error argues a lack of direct contact with and experience in the practice of copper metallurgy.

COMPANY REPORTS

Granville Mining.—This company was formed in August 1911 to acquire a large number of gold gravel properties on the Indian river and its tributaries, from 15 to 25 miles southeast of Dawson, Yukon Territory. It takes its name from the settlement of Granville, situated at the junction of Dominion and Gold Run creeks, as marked on the accompanying map. The promoters were A. N. C. Treadgold, H. C. Hoover, A. Chester Beatty. The share capital amounts to £1,400,000, which was paid as purchase price, and there are £900,000 debentures. Of the latter £440,000 have recently been issued, and of the funds thus raised,

by the capitalists interested in Klondyke during the last few years has been to consolidate the properties on a large scale and to work the gravels continuously, instead of picking the best streaks, as was the only method possible for the small man. The first consolidation was the Yukon Gold Co., which owns large tracts in Bonanza and Hunker creeks. The Canadian Klondyke Co. owns property chiefly along the Klondyke valley in the near vicinity of Dawson. For some years a single dredge with 7-cu. ft. buckets was used, and at the end of 1910 a large dredge with 16-cu. ft. buckets was installed. The profit during 1911 was £45,000. It is estimated that the property contains 100,000,000 cu. yd. of proved gravel averaging 10d.



£300,000 is being devoted to the financing of the Canadian Klondyke Co., usually known as Boyle's Concession. In return, the Granville company receives \$1,500,000 debentures of the Canadian Klondyke Co., together with 29% of its share capital. The Granville has the option for three years to convert the debentures into 20% of the share capital of the Canadian Klondyke, and it is announced that this option will be exercised. With the money thus provided by the Granville company, the Canadian Klondyke will build two more powerful dredges with 16-cu. ft. buckets. The prospectus offering the new debentures contains much information relating to economic conditions at Dawson, and further circulars are now being issued in connection with the introduction of the Granville shares on the Stock Exchange. The policy pursued

per yard, and that the cost should not be more than 2½d. per yard. There is also a similar amount of gravel not fully prospected, of which one-half is taken as profitable. The Granville company owns property estimated to contain 600 million cubic yards, of which one-half averages 15d. per yard. The company also owns a hydro-electric power station of 10,000 horsepower, operated by a subsidiary company, and a highly profitable contract has been made with the Yukon Gold Co. for the supply of power. The most interesting item in the report is the description of the method which makes it possible to treat these gravels by dredges. Hitherto much of the gravel has been permanently frozen and resort had to be made to steam thawing and other similar devices. It was found however that if the overlying deposit of peat and moss were

stripped and the earth laid bare to the summer sun, the gravel would be gradually thawed. The stripping may be done mechanically, or by drainage and burning. The gravel on the higher parts is to be hydraulicked. The Granville company is now preparing its property for treatment and should be producing gold in 1914; in the meantime it will be receiving a substantial income from its holdings in the Canadian Klondyke company.

Prestea Block A.—This company was formed in 1903 to acquire from the Prestea Mines and the Apantio Mines companies portions of the Essarman and Intermediate properties in the Prestea district, Gold Coast Colony, West Africa. Milling commenced in 1906, and was suspended in 1909 in order to rebuild the plant and to push forward the development work. Milling was resumed in May 1911, but the 110 stamps could not be utilized as the capacity of the shafts was not adequate. The North inclined shaft was therefore started. In 1909, 250,000 new £1 shares were subscribed by Wernher, Beit & Co., and in 1910, 100,000 additional shares were sold to shareholders. In January 1911, a further 199,876 shares were issued as purchase price for the property of the Prestea Mines company, so that the total issued capital is now £1,049,876. Still further funds have been required and £175,000 has been advanced conjointly by the Central Mining and the Fanti Consolidated. Edmund Davis is chairman of the company, H. F. Marriott is consulting engineer, and William Crosley has recently been appointed manager, in succession to E. Homersham. The report now issued covers the year 1911, and shows that from the beginning of May 1911 when the mill resumed until the end of the year, 93,483 tons of ore was raised and treated, yielding gold worth £160,346, or 34s. 3d. per ton. During this time, the working expenses amounted to £131,927, or 28s. 2d. per ton; in addition £4674 represents the expenditure in London, and £21,253 was written off for depreciation, and the balance £2701 was carried forward. During the year, 183,000 tons was added to the ore reserve averaging 44s. 6d. per ton, and the total reserve on December 31 was 975,101 tons averaging 41s. 6d. per ton. During the five months January to May of this year, 64,766 tons was milled producing gold worth £110,530 or 34s. 1d. per ton, and the cost, not including London expenses and depreciation, was £82,828 or 25s. 6d. per ton. Arrangements are being made for filling exhausted stopes with tailing and other material. There is still scope for improvement in the extraction from the sand, and the slime, which contains over 9s. per ton, has not yet been treated. The new electrical power plant is at work. At the present time only 60 of the stamps are employed.

Pena Copper.—This copper and sulphur mine in the South of Spain has been worked by an English company since 1900, having been previously controlled in Belgium. The finances and methods of management were thoroughly reorganized when the English company was formed. Dividends of 5, 5, 4, and 7½% were paid from 1903 to 1906, but none since. During 1909 special expenditure was incurred in connection with the removal of overburden, and in 1910 and 1911 the profits were conserved owing to the dispute with the Rio Tinto company in the matter of marketing the products, and also for the purpose of providing a railway service independent of the Rio Tinto. Two years ago it was decided to sell a larger proportion of ore for export, and to treat less on the spot for its copper content. The report for 1911 shows that 131,367 tons of ore was mined. Of this 49,388 tons was sent to the heaps for leaching, and 81,979 tons was prepared for

export. The shipments during the year were 49,334 tons of leached ore, 58,238 tons of sulphur ore, and 16,751 tons of cupreous ore, making a total of 124,323 tons. At the leaching floors, precipitate containing 1004 tons fine copper was produced. On December 31 the amount of ore in the heaps under treatment was 500,714 tons estimated to contain 3423 tons copper. The rainfall during the past winter was heavy, so that the supply of water is now ample. The net profit for the year was £35,599, out of which £11,400 has been devoted to the redemption of debentures, and the balance has been carried forward, making a total balance of £75,936. The issued capital is £537,600, and there are £20,900 outstanding debentures. The construction of the new railway from Pena to Castillo de las Guardas was begun last October, and it is hoped that it will be finished next spring. As the present transport contract with the Rio Tinto expires in the coming October no shipments of ore will be possible in the meantime. To prepare for an increased output when the new railway is ready, a greater amount of development work is being done. The 11th level is now ready for mining ore by underground methods, and the shaft is being sunk to the 12th level.

San Miguel Copper.—This company was formed in 1904 to acquire from Spanish proprietors the San Miguel copper and sulphur mine in the South of Spain. The directors resigned three years afterward, as their management had not been a success, and the control then passed into the same hands as the Pena. The report for 1911 shows that 68,476 tons of ore was raised, of which 42,987 tons was sent to the heaps for leaching, and 25,489 tons prepared for export, most of the latter being cupreous. The washed ore shipped during the year was 76,550 tons, and the precipitate produced contained 772 tons copper. The net profit made was £12,885, which was carried forward. The development work has given satisfactory results and the reserve is fully maintained.

Troitz Goldfields.—Two years ago we gave a review of the past history of this Siberian mine, and showed how, after early disasters, Hooper, Speak & Co. were asked to undertake the reorganization and rehabilitation of the enterprise. A new treatment plant consisting of Chilean mills and cyanide vats was erected by H. C. Bayldon, the local partner of the firm. The new mill started in August 1909, and it was described by Mr. Bayldon in a paper read before the Institution of Mining and Metallurgy. Unfortunately operations were suspended by a fire in the main shaft on May 12, 1911. The timbering was entirely burnt to a depth of 260 ft., and seriously damaged to 500 ft.; the shaft caved for 30 ft. at the top; the shaft buildings and hoist were destroyed, and the pumps and compressors damaged. The mill was stopped on June 13, after all the available ore on the surface was treated. The report for 1911 now issued announces that the damage has been made good. The mine has been unwatered to 500 ft. (the depth of the main shaft is 802 ft.); the shaft has been timbered from 100 ft. to 430 ft., and the top 100 ft. lined with reinforced concrete. Development is being actively pushed and it is intended to resume milling in September. During the time the mine and mill were in operation, from the beginning of 1911 to the occurrence of the fire, 15,533 short tons of ore was raised, yielding 4277 oz. gold by amalgamation, 767 oz. by cyaniding sand, and 274 oz. by cyaniding concentrate. The slime is at present being impounded, 5319 tons being stored in this way during the period under review; the total amount awaiting treatment is 63,000 tons averaging 2 dwt. The slime-treatment plant is in course of erection. The ore re-

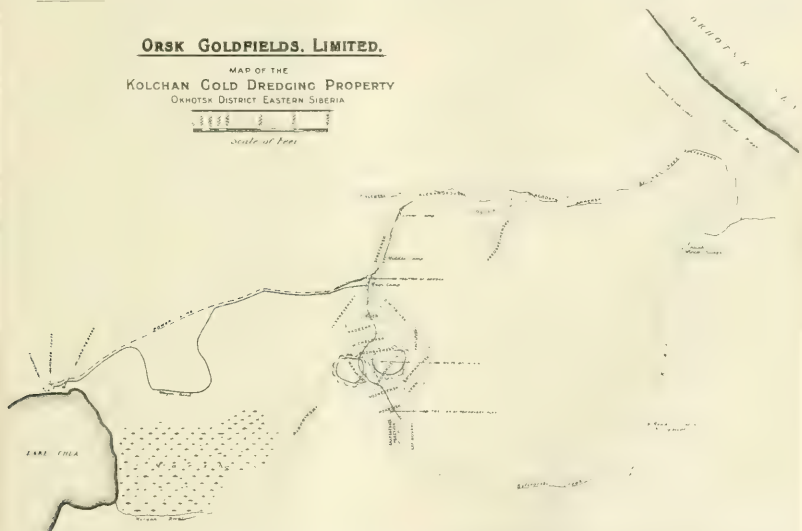
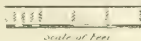
serve is calculated at 39,850 tons averaging 7.85 dwt. The report by Mr. Bayldon mentions that the stopes have been narrowed and that the breaking of the roof is cleaner. This has slightly raised the mining cost, but it has substantially increased the grade of the ore milled. In order to meet the cost of the fire and to provide for further extensions, 105,488 priority shares of £1 each were issued in November last. These were subscribed by the parent company, the Siberian Proprietary.

Orsk Goldfields.—This company was formed by the Siberian Proprietary in 1906 to acquire gold mines in the province of Orenburg in the Southern Ural region, but on these proving valueless a gold gravel property near Nicolaievsk on the Okhotsk sea in Eastern Siberia was acquired. We gave a detailed account of this property and of the plant in our issue of August 1910. A stacker-scow was first erected on

resumed operations on May 23 of this year and the dredge on May 18. During 1911, 80,000 additional priority shares of £1 each were subscribed, as recorded in our pages at the time, in order to restore the finances of the company to a sound position after the catastrophe to the dredge and the delay in its erection.

Kyshtim Corporation.—This company was formed in October 1908 to acquire the share capital of the Kyshtim Mining Works Co., the Russian company which owns and operates copper, iron, and gold mines in the Perm district of the Southern Urals. In addition the company has made loans to the Russian company amounting to £761,152, for the purpose of re-organizing the mining and metallurgical work at the copper mines. The capital is £1,000,000 in ordinary shares, and there are £650,000 debentures. The report for 1911 shows that 247,102 long tons of ore was

ORSK GOLDFIELDS, LIMITED.
MAP OF THE
KOLCHAN GOLD DREDGING PROPERTY
OKHOTSK DISTRICT EASTERN SIBERIA



the Pokrovsky claim, and subsequently a dredge was ordered from New York. The delivery of the latter was delayed by a collision outside New York harbour, and it was not finally put into commission until the end of October 1911. Various distinguished American engineers have been in charge, namely, C. W. Purington, D'Arcy Weatherbe, and C. H. Munro, and W. H. Lanagan is now the manager. The report for the year 1911 shows that the Pokrovsky plant was in operation from May 14 to October 18 and extracted gold worth £24,155 from 88,654 cu. yd. of gravel. The dredge ran intermittently from October 25 to December 5, extracting gold worth £2830 from 47,089 cu. yd. of gravel. The total yield was therefore £26,985. The operating cost, administration charges, and winter up-keep amounted to £11,835, the royalty paid was £5921, depreciation £3845, expenses in London £3157; these expenses together with small items reduced the profit to £1557. The Pokrovsky plant

raised from the Koniukhoff, Smirnof, and Tissoff mines, averaging 3.19% copper. The amount of ore treated at the new smelting plant at Karabash was 218,310 tons, and at this plant and at the old Kyshtim works, where matte, flue-dust, etc., are still treated, the total production of blister copper during the year was 5020 tons. At the electrolytic refinery, 4033 tons of copper was produced, together with gold and silver slime that sold for £55,321, or £13.14s. per ton of copper. The cost of operations, including mining, smelting, transport, and general expenses, was 15s. per ton of ore, or £34½ per ton of blister copper. The reserves as estimated by R. Gilman Brown in June of this year amounted to 1,699,000 tons averaging 3% copper, 2 dwt. gold, and 1 oz. silver per ton. At the Karabash smelter, a third blast-furnace was started in May of this year. The dust-chambers have been enlarged, and the main chimney heightened by 60 ft. A second reverberatory has been started at the Kyshtim

works to treat the flue-dust and fine ore. It is probable that the output of copper during 1912 will be 7000 to 7500 tons. The Russian company made a profit of £172,394 on the copper production, £23,439 at the iron works, £29,651 in the timber business, and £4919 from the sale of pyrite for sulphuric acid manufacture. The general expenses, taxes, and interest on mortgages and bankers loans absorbed £119,135, and £30,033 was written off for bad debts, while £65,200 was remitted to the English company. Out of the latter £23,657 has been paid as debenture interest, £9289 was paid as directors' fees and London expenses, and other amounts debited for formation expenses and discount on new debentures, etc. The ordinary shareholders in England have not yet received any return. We may remind our readers that in our June issue we published an important paper by H. W. Turner on the ore deposits worked by this company.

Associated Gold Mines of Western Australia.—This company was formed in 1894 to acquire the Australia and other claims at Kalgoorlie. Dividends were first paid in 1898, and the shareholders received 55% in cash during the subsequent 18 months, in addition to shares in subsidiary flotations. Further dividends have been paid from 1903 onwards, in gradually decreasing amounts. Two and a half years ago the company arrived at a crisis, when it was discovered that errors had been made in the sampling of the reserve, the corrected figure being nearer 6 dwt. than the 10 dwt. previously reported. George M. Roberts resigned, and D. F. McAulay succeeded him. Since then the mine has been producing regularly, but all the profit has gone to development. The report now issued covers the year ended March 31 last. From this it appears that 118,735 tons of ore was treated averaging 6.8 dwt. or 29s. per ton. The recovery was 38,477 oz. gold worth £163,538, or 27s. 6d. per ton. The profit and loss account shows a balance of £33,062, out of which £28,532 is written off for development expenses, and £4040 for depreciation of investments, chiefly Consols and Transvaal Government Stock. Mr. McAulay states that the probable ore reserve is about 500,000 tons, containing from 21s. to 29s. per ton, no nearer approximation being possible. Development is being pressed at various points, and renewed attention is being given to the unexplored parts of the upper levels.

Broken Hill Block 10.—As we recorded in our January issue, the concentrating plant at this mine was closed in August last for a thorough overhaul and reconstruction, the advice of George Weir, of the North Broken Hill, having been obtained. The half-yearly report for the period ended March 31 last now issued states that practically the whole of the time was occupied with this re-organization, and that the mill recommenced operations experimentally as recently as March 21. Consequently the only revenue was derived from the sale to the De Beavay Co. of old tailing, amounting to £10,049. O. B. Ward, who succeeded V. F. Stanley Low as manager on January 1, has re-sampled the mine, and has written down the reserve to 283,500 tons as compared with 566,246 tons in March, 1911. Some of the decrease is accounted for by the rejection of ore of doubtful profitability, and part to Mr. Ward's policy of excluding ore not exposed on three sides. A re-survey of the old tailing dumps showed a deficiency of 700,000 tons as compared with the original estimates. This loss is due largely to dust storms, but partly to neglect to allow for the contour of the ground on which the tailing was stacked. The new mill consists of 2 pair of rolls, 8 grinding pans, 16 concentrating tables, 8

slime-vanners, 4 sand-settlers, and 4 slime-settlers, together with a complete system of elevators, belt-conveyors, and electric motors.

Broken Hill Block 14.—This mine is situated between the Broken Hill Proprietary and the British Broken Hill mines, and during the last few years operations have been confined to the removal of carbonate ore left in the upper levels. During the half-year ended March 31, 11,732 tons of this ore was raised, assaying 30.27% lead and 14.88 oz. silver, figures not much different from those of recent similar periods. F. Voss Smith, the manager, reports that there is a probability of this rate of output being maintained for some time, though he is unable to give any definite estimate of reserve. As regards the large amount of low-grade sulphide in the lower levels, a parcel of 200 tons was sent to the Zinc Corporation for testing, and the results are reported as "fairly satisfactory." A second and larger amount of ore has since been sent to the Corporation's works. Diamond-drilling has been continued, but without results. The income of the company for the half-year from the sale of carbonate ore was £34,067, and from the sale of slime £3000. The profit was £11,603. Out of this £1500 has been paid as interest on the £30,000 preference shares. The £125,000 ordinary shares receive £25,833, being at the rate of 2s. 7d. per 25s. share, part of the amount distributed coming from the balance brought forward from the previous half-year.

Wheal Kitty & Penhalls.—In writing six months ago of the results at this tin mine in the St. Agnes district of Cornwall, we had to record with regret that the content of the ore mined had seriously fallen, the yield for the second half of 1911 having been 19.9 lb. black tin per ton, as compared with 28.1 lb. during the first half, and 35.2 lb. during the period from the commencement of work by the present company under the auspices of J. H. Collins to the end of 1910. The report for the first half of 1912 shows a substantial improvement in the yield, the figure being 28.5 lb. black tin per ton. The mine suffered inconvenience from the coal strike, as operations had to be entirely suspended for five weeks. This fact and also closer sorting underground caused the total amount of ore raised to be less than usual, 6090 tons, as compared with 8384 tons the previous half-year. The tin concentrate sold was 77 tons realizing £6448. The net profit was £702, which, added to the balance carried forward from the previous half-year, made a disposable balance of £1522. Out of this, £375 has been written off for depreciation, and £298 has been paid as dividend on the preference shares at the rate of 10% per annum. The total cost was 28s. 8d. per ton. Sara's shaft is now down 750 ft. and a lode cut at 720 ft. is now being developed. This is supposed to be the faulted portion of the main Kitty lode which was the objective in sinking the shaft. The cross-cut at 540-ft. level connecting Sara's with the Wheal Vottle workings is nearly complete.

Northern Copper (B.S.A.).—This company was formed in 1895 to acquire prospecting and mining rights in various parts of northern Rhodesia. In 1902 a number of the properties were handed over to a subsidiary, the Rhodesia Copper company, which, in turn, acting in concert with the parent company, floated three separate organizations, namely, the Rhodesia Broken Hill, the Kafue Copper, and the Bwana M' Kubwa Copper. The Rhodesia Copper also has a financial interest in the Rhodesia-Katanga Railway and Mineral Co., which is under the control of the Tanganyika Concessions and owns the Kansanshi copper mine. The report of Northern Copper for the

year ended May 31 shows that 363,000 shares in the above-named companies are held, valued at £116,120. The liquid resources consist of cash £4160, and loan against security £43,000; and there is also a loan of £31,212 to the Kafue Copper company secured on copper matte produced. The company still owns a number of mineral concessions that are awaiting development, and these are valued at £38,042. Edmund Davis is chairman of this group of companies and Percy Tarbutt & Co. are the engineers. Further particulars are given in the following paragraphs.

Rhodesia Copper.—Particulars of this company, the full name of which is the Rhodesia Copper & General Exploration & Finance Co., are given above. The financial statement for the year ended May 31 shows the unissued capital to be £437,661 in 7s. 6d. shares.

been ordered, and should be at work before the end of the year. Further exploration at depth has disclosed large masses of sulphide ore, 'disseminated chalcocite,' and between the 350-ft. and 550-ft. levels it is estimated that the probable ore is $2\frac{1}{2}$ million tons, of unspecified grade.

The Kafue Copper company owns a number of properties in the hook of the Kafue river, the Sable Antelope and the Silver King being the chief. A 25-ton smelter erected at the former started work in August 1911, and during the eleven months to June 30 produced 1990 tons of matte averaging 72% copper, and containing 70,000 oz. silver. Owing to the cost of transport this matte has not yet been shipped. The reports as to the future of these properties are not quite reassuring. The results of development at the



Among the assets are shares in subsidiary companies valued at £156,790, investments in other companies and in government stocks £127,446, cash £31,732, secured loans £50,000, other loans £12,350; while other extensive properties awaiting development are valued at £48,025. The profit and loss account shows an income of £9790 from loans and investments, but expenses in London and losses incurred in the realization of certain shares more than counterbalance this, and the year ended with an adverse balance of £558. The report gives details of the work of the subsidiary companies.

At the Bwana M'Kubwa, 12,552 ft. of development has been done to date. Above the 350-ft. level the ore reserve consists of 120,000 tons of 14% ore, and 750,000 tons of 5% ore, all oxidized. Experiments have been conducted in London with a view of finding the best process, and an electrolytic leaching method has been adopted. The first part of the plant, having a capacity of 75 tons of high-grade ore per day, has

Silver King are not hopeful and work has been suspended. At the Sable Antelope the development disclosed 7000 tons averaging 16% copper and 5000 tons averaging from 4 to 5%. The high cost of operations, and of transport, together with the royalty payable to the British South Africa company make it doubtful whether work can be continued. At the Crystal Jacket mine, 4 miles from the Sable Antelope, a promising body of carbonate ore has been found. The company also owns the Hippo mine, where exploratory work has given good results. Above the 100-ft. level, 5000 tons of 15% copper ore carrying 4 dwt. gold per ton has been disclosed. We should add that all the properties consist of ancient workings. As regards the properties of other subsidiaries, the Broken Hill zinc mine and the Kansanshi copper mine are not at present being worked. The Rhodesia Copper company owns large tracts of undeveloped properties in various parts of northwestern Rhodesia, the Rhino, Chick, Lewis, and Roan Antelope being the most promising

copper claims. For the map illustrating this district we are indebted to J. M. Moubray's new book 'In South Central Africa.'

Transvaal Gold Mining Estates.—This company was formed in 1895 to acquire properties in the Pilgrim's Rest district of Lydenburg, Transvaal. At the present time the Clewer, Peach Tree, Theta, and Graskop gold mines are being worked as a group, and are called the Central mines, and the Elandsdrift and Vaalhoek mines are under separate management. The control is with the Central Mining Corporation; S. Aimetti is general manager, with W. Patrick as manager at Elandsdrift, and G. Carter at Vaalhoek. The report for the year ended March 31 shows that at the Central group 121,458 tons was raised and treated in the 60-stamp mill. The yield by amalgamation was worth £168,396 and by cyanide £151,657, a total of £320,053 or 52s. 8d. per ton. The working cost was £142,773 and the profit £178,269. At the Elandsdrift, the 5-stamp mill treated 7930 tons, yielding by amalgamation and cyanide gold worth £39,366 or 99s. 3d. per ton milled, and at the Vaalhoek the 10-stamp mill treated 15,093 tons, yielding gold worth £22,400. The profit at the Elandsdrift was £29,484 and at the Vaalhoek £5349, bringing the total working profit at all the mines to £213,103. There was an income of £10,248 from other sources, and the cost of administration and debenture interest was £18,248, leaving a profit of £205,104. Out of this, £18,582 has been paid as tax, and £166,165 distributed as dividend, being at the rate of 27½%. The total ore milled since 1895 has been 1,273,487 tons, the yield 752,986 oz., the revenue £3,163,180, and the dividends £830,809. The ore reserves at the Central group have been well maintained, and stood on March 31 at 349,719 tons averaging 14 dwt. per ton. The reports as to the future at the other two mines are also encouraging.

Treasury Gold.—This is one of the small mines on the central Rand and adjoins the Geldenhuis and Jumpers. During recent years it has been under Neumann control. Eighteen months ago, as it and its near neighbour, the Jumpers, which is under Central Mining control, were approaching exhaustion, an arrangement was made to work the two conjointly, using the Jumpers mill. During the year ended March 31, the amount of ore raised from the Treasury was 80,133 tons and from the Jumpers 40,202 tons. The output from the latter was much lower than anticipated, and as the ore in this mine is of better grade than that in the Treasury, the average grade of the ore treated and also the profits have decreased. The share of the profit due to the Treasury was only £5832. S. C. Thomson, the consulting engineer, states that there is in both mines a considerable amount of ore that may be profitably treated, but it is scattered over many remnants of blocks in caved areas, and operations may have to be suspended at any time. It is probable that small profits may continue to be made for a year. The company has a cash balance in hand of £86,618.

Shamva.—This company was formed in April 1910 to acquire and develop a gold property in the Abercorn district of Rhodesia. The issued capital is £500,000, of which £250,000 in shares was paid as purchase price; 100,000 shares were issued at £2, and 150,000 at par. The control is with the Consolidated Gold Fields, and H. A. Piper is consulting engineer. A 5-stamp mill was provided to test the ore, but the full plant will not be erected until the completion of the branch railway from Mazoe. This plant will consist of 56 Nissen stamps together with tube-mills, and the capacity will be 50,000 tons per month. Work is

centred on development. This is done by adits on four levels. During the year 1911, the reserve has been greatly increased, and the assay-value of the newly-found ore is much higher than that of the reserve a year before. The ore developed during the year was 1,072,746 tons averaging 6·17 dwt., and the reserve a year ago was 1,019,113 tons averaging 3·72 dwt.; the total reserve on December 31 last was therefore 2,091,859 tons averaging 4·97 dwt. The development during 1911 amounted to 9773 ft., bringing the total work done to 24,699 ft. which has cost £66,971. As regards the nature and extent of the orebody, it appears from Mr. Piper's report that on the prospect level the orebody is 740 ft. long, averaging 88 ft. wide, with content 3·8 dwt. per ton. On the 1st level the length is 920 ft., width 110 ft., and content 4·14 dwt. On the 2nd level the length is 820 ft., width 97 ft., and content 6·77 dwt. On the 3rd level the results have not been so good, as in several places the width of profitable ore is comparatively small, but the average content is higher, being 7·44 dwt. per ton.

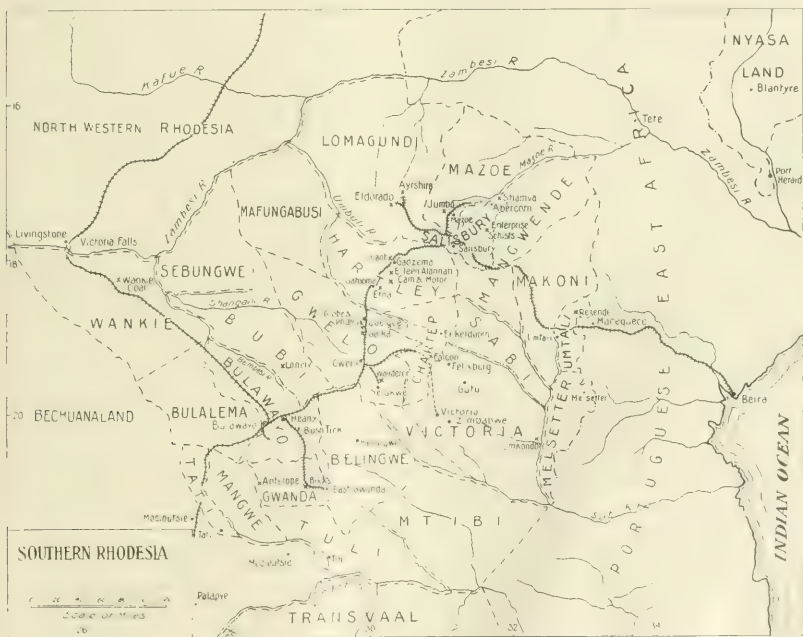
Wanderer.—This company was formed in 1899 to acquire the Wanderer, Ashton, and other gold properties in the banded ironstone of the Selukwe district of Rhodesia, and production started in 1902. Of recent years the average content has been very low. In the summer of 1909 the company was reconstructed and additional capital raised, for the purpose of purchasing the Camperdown property near by. The report for the year ended April 30 shows that 219,400 tons of ore was mined and treated by dry-crushing with rolls and cyanidation; of this amount 20,847 tons came from the Wanderer, 9993 tons from the Ashton, 62,794 tons from the Kemerton, and 125,766 tons from the Camperdown. The assay-value of the ore averaged 2·6 dwt. per ton, and of the tailing 0·6 dwt. The yield was 21,740 oz., or 2 dwt. per ton. The output of ore was 24,166 tons greater than that of the previous year, which itself was a record. On the other hand, the assay-value of the ore and the yield per ton were less by $\frac{1}{8}$ dwt. and $\frac{1}{8}$ dwt. respectively. The amount left in the tailing was $\frac{1}{2}$ dwt. less this year as compared with last year. The working cost was 7s. 6d. per ton as compared with 8s. The development done amounted to 8647 ft., an increase of 2318 ft. over the previous year. A large amount of overburden, 79,917 tons, was removed at the Camperdown and Kemerton mines. The revenue from the sale of gold was £92,365 and the working cost £82,631. In addition £2092 represented London expenses, and the profit, £7902, was carried forward. The ore reserve is estimated at 350,925 tons, a decrease of approximately 70,000 tons. During the year Percy Tarbutt & Co. resigned as consulting engineers and were succeeded by Noel Griffin; H. Wiley is now manager in place of J. B. Little.

Antelope.—This company was formed in 1908 to acquire a gold property in the West Gwanda district of Rhodesia, 60 miles south of Bulawayo. It belonged to the Rhodesian Exploration & Development group, but during the year the control has passed to the Consolidated Gold Fields. H. A. Piper has succeeded H. Ewer Jones as consulting engineer. The policy has been to develop the property thoroughly before erecting a treatment plant. The report now issued covers the year 1911 and shows that developments have continued to add to the reserve chiefly in the main ore-shoot; the parallel veins and the veins in the east and west extensions have not done so well. The reserve in the main shoot on December 31 last was estimated at 102,602 tons averaging 10·2 dwt. The shaft is now down to the 8th level, and the winzes below this are

in satisfactory ore. The sinking of the shaft is to be prosecuted actively. The dikes encountered at various points have not so far interfered with work or with the continuity of the lode. Mr. Piper mentions that the foot-wall in some parts is of such a character that a good deal of waste will probably be mined with the ore, and the average assay-value of the ore milled may be lower than the figure given for the ore reserve. It has been decided to adopt H. T. Brett's proposals for the metallurgical treatment of the ore. The plant will consist of ball-mills, Edwards roasting furnaces, grinding and amalgamating pans, and cyanidation of the slime. The capacity will be 4000 tons per month.

Willoughby's Consolidated.—This company was formed in 1894 to consolidate various land and mining interests in Southern Rhodesia owned by Sir John Willoughby and others. Sir John is still one of the

£27,644 from profits on investments realized, £29,316 from land property, and other small items bringing the total income to £136,037. The profit was £56,980, and £94,425 was brought forward from the previous year. Out of this, £37,739 has been written off in connection with the issue of the new debentures, £50,000 has been written off the value of shares in subsidiary companies, and £30,000 has been transferred to reserve. The company owns shares in the Matabele Queen, Surprise, and Chicago-Gaika. In November last the Eileen Alannah Co. was formed to take over property on the Eileen Alannah and Arizona lodes, and the Connemara Mining Co. has recently been formed to work claims in the Gwelo district. The company is working the Eiffel Blue near the Eileen Alannah, and lets on tribute six other properties equipped with milling plant.



managing directors, and the control is with the British South Africa Company. The only dividend paid was 5% for 1910. New capital has been subscribed at various times. During 1911, 128,000 reserve shares of 10s. each were issued at a premium of 25%, and during the current year 22,883 further shares have been sold, bringing the total to 1,400,628, equivalent to £700,314. In addition, £149,800 5% debentures were issued in connection with the purchase of the assets of the Matabele Reefs & Estates company. There are also outstanding £54,100 6% debentures. The report for 1911 shows a revenue of £53,926 from gold produced, £22,569 from profits on the sale of mining interests,

Eldorado.—This gold mine in the Lomagundi district of Rhodesia was floated in 1906 by the Rhodesia Exploration & Development Co., but during the past year the control has passed to the Consolidated Gold Fields. The ore is refractory and in places rich, and extraction is effected by stamps, Chilean mills, wheeler pans, and cyanide plant. As a producer the mine shares with the Giant the second place to the Globe & Phoenix. The report now issued, covering the year ended March 31, shows that the developments at the 8th level have been disappointing owing to faulted ground, and that the ore reserve has in consequence diminished. The amount of ore treated was 87,315

rons. The extraction by amalgamation in the stamps, mills, and pans was 38,416 oz. gold, and by cyanide 12,189 oz., making a total of 50,605 oz., or 11 6 dwt per ton. The revenue from the sale of gold was £218,153, and other items brought the income to £219,668. The working expenses were £97,400, London and other expenses £5577, and £23,719 was written off for depreciation of plant and buildings, leaving a profit of £92,972. The dividends absorbed £90,000, being at the rate of 30%, and £3000 was paid as directors' percentage of profits. The ore reserve on March 31 was estimated at 149,749 tons averaging 15 13 dwt., as compared with 197,343 tons averaging 16 36 dwt. a year before. As already mentioned the cause of this fall is chiefly the faulted nature of the 8th level, but the difficulty of developing from the incline shaft accounts for part. A vertical shaft is being sunk to cut the deposit at the 8th level, and when it is completed this autumn development work on the 9th and 10th levels will be pushed actively. On the results of this work depends the future of the mine. H. A. Piper, the new consulting engineer, states that hitherto the method of estimating the content of the reserves has been faulty, as the screen assays have consistently been 2 or 3 dwt. less than the sampling assay. This is due to the rich patches figuring too prominently in the sampling results. He considers that the content of the reserve now given as 15 13 dwt. is 2 3 dwt. too high.

South American Copper.—In our issue of April last we gave some particulars of this company, which was formed in 1907 for the purpose of reopening the Aroa group of copper mines in Venezuela. These mines have been known for 300 years, and from 1882 to 1894 they were worked by the Quebrada company, an English venture. In the latter year the workings collapsed and the property abandoned. The report now issued covers the year ended June 30. During this time the ore extracted and shipped to Europe realized £75,447 gross. The cost of mining, freight, smelters, charges, etc., was £47,803, leaving a profit of £27,644. Out of this, £2595 was paid as London expenses and income tax, and £2510 as directors' extra remuneration. Dividends amounting in all to £22,358 have been paid, which is 250% on the paid-up capital of £9883. The nominal capital of the company is £15,000, divided into 150,000 shares of 2s. each. Of these, 75,000 formed the original issue at par, and the other 75,000 have been issued at £1 each. So far £20,170 has been paid up on the latter. These shares have been subscribed in France, and the money obtained will be available for the expansion of mining and concentration operations. W. A. Heywood has gone to the mines to report on the metallurgical problem.

De Lamar.—This company was originally formed in 1891 to acquire from Henry Bratnover the gold-silver mine previously worked by J. R. De Lamar in Owyhee county, Idaho. For 5 years the mine did well and returned English shareholders 107 1/2% on the capital, £400,000. After that the profits fell and the subsequent 16 years have seen only an additional 40%. In 1901 the nominal capital was written down to £80,000. The report now issued covers the year ended March 31 and shows that the mine is still producing ore, but the cost of exploration and mining is high and no profit has been made. The amount of ore raised was 43,629 tons (dry) averaging 10 50 s per ton. This, together with 4967 tons of coarse tailing, was ground in Chilean mills and cyanided, after which some sulphide was removed by vanners. The concentrate thus obtained was at one time shipped to smelters, but the

amount recovered now is small, and it is re-ground and returned to the cyanide plant. The yield during the year under review was 14,656 oz. gold and 279,723 oz. silver, selling for £91,811. The cost at the mine was £91,132. The unexpended capital in hand was £38,978. The cost per ton for mining and development was \$6 00 per ton, and this high figure is accounted for by the fact that there are no reserves. The mine is a vast ramification of old workings, and the ore is picked from old stops, fillings, and small veins. E. V. Orford, the manager, is not able to give any estimate or prognostication as to the future.

TRADE NOTES

Most of the trade publications mentioned in this column are available for distribution and the manager of The Mining Magazine will be pleased to secure copies for persons interested.

The Byron Jackson Ironworks are the pioneer pump manufacturers of the Pacific Coast. Bulletin No. 40 describes their multiple-stage turbine and series centrifugal pumps.

The Sandycroft Foundry Co. Ltd. announce in a recently published circular the particulars of a 'Hand Stamp for Prospectors' at the reasonable price of £15, packed f. o. b. Liverpool. The machine is stated to have a capacity of between 500 and 600 lb. per day on 1 1/2 in. feed crushed to 25-mesh. The approximate shipping weight is 455 lb.

E. T. Newton & Son, Ltd., Scientific and Mathematical Instrument Makers, have sent us their new catalogue and price list. The firm was established in 1823, and has made a specialty of mining theodolites. The plant in Cornwall is situated in the centre of a large mining district, and consequently the firm has been in a position to follow the actual working of their instruments and promptly make the improvements suggested in actual practice.

Chester's Renfrew Engineering Co. have sent us section 3 of their new catalogue dealing with 'Steam and Electric Hoists and Accessories,' and Section 6 on 'Air Compressors.' Both catalogues are well-printed and should be useful to any engineer contemplating the purchase of new machinery. The tables are numerous and good, and provide excellent short cuts in calculating capacity, horse-power, dimensions, and innumerable other important details required in preparing estimates.

George Cradock & Co. can well be proud of the seventh edition of their catalogue. The introduction to this 170-page book states that each edition has been larger than its predecessor, and we can appreciate that the growth of the catalogue each year has not only followed the expansion of the firm but likewise the growth in the number of ropes of different qualities and construction manufactured to fit the varying working conditions for which they are intended. Such factors as speed, the size of drums and pulleys, the load, the gradient when used on an incline, etc., are important matters to be taken into consideration, and the buyer can well leave the choice of the rope best suited for his particular purpose in the hands of a firm that has made a specialty of this business. Additional confidence can be placed in these ropes by the knowledge that the whole of the material used is manufactured on the premises from the raw material. Last month the King and Queen were interested spectators of the entire process of making wire ropes at the works in Wakefield.

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Scientia non habet inimicum nisi ignorantem.

T. A. RICKARD, Editor.

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CONTENTS.

	PAGE		PAGE
STATISTICS OF PRODUCTION.....	160	DISCUSSION	
REVIEW OF MINING.....	161	Phantom Profits.....	
EDITORIAL		..... S. J. Speak, Ernst Lichtenberg	215
Notes.....	167	Mining Schools.....	A. G. Charleton 217
The Far Eastern Rand	170	Oroville Dredging Co.....	
Cobalt.....	172	..... George E. Tilley	218
In Mexico.....	174	Prospecting.....	Stephen J. Lett 218
Mount Morgan	174	Hemp Ropes.....	Frank Harvey 219
Mining in Frozen Ground.....	176	Cornish Tin Ticketing.....	
Dangers of Inexperience.....	177	..... Amos Treloar, Edward Walker	219
Efficiency.....	178	PRÉCIS OF TECHNOLOGY	
Illiterate Technology	180	Multiple-Deck Slime-Concentrator....	221
SPECIAL CORRESPONDENCE		Rolls versus Stamps.....	221
Seoul.....	181	Solubility of Gold in Nitric Acid.....	222
Kalgoorlie	182	Sulphuric Acid Manufacture.....	222
San Francisco.....	184	World's Iron and Steel Production....	222
Johannesburg	186	French's Zinc Process.....	223
Toronto	189	Zinc Metallurgy.....	223
Camborne.....	191	Indian Magnesite	223
Melbourne.....	194	Geology of Ecuador.....	224
New York.....	195	Losses in Ore-Drying.....	226
PERSONAL.....	198	Absorption of Water by Coke.....	226
METAL MARKETS	206	Depths of West Australian Mines.....	227
ARTICLES		Mine-Tributing in Rhodesia.....	227
The Mexican Oilfields.....		The Hendryx Agitator.....	228
..... Sydney A. R. Skertchly	199	CURRENT LITERATURE.....	228
Aspects of the Mexican Situation.....		BOOKS REVIEWED	228
..... An American Mining Engineer.....	204	COMPANY REPORTS.....	230
The Corocoro District, Bolivia.....		TRADE NOTES	236
..... Lester W. Strauss	207		

STATISTICS

STOCKS OF COPPER IN ENGLAND AND THE CONTINENT.
Reported by Henry R. Metton & Co. Tons of 2,240 lb

	June 30 Tons	July 31 Tons	Aug. 31. Tons
In England	25,633	26,640	29,550
In France	5,485	7,476	7,886
Abat from Chile	1,475	2,900	2,660
Abat from Australia	6,000	6,000	5,660
In Rotterdam	1,350	1,350	1,350
In Hamburg	2,195	4,828	4,120

Total European visible supply

48,118 50,574 50,332

AMERICAN COPPER PRODUCERS' ASSOCIATION'S FIGURES.
In Tons of 2,240 lb.

	Produc- tion	Domes- tic	Deliveries Foreign	Total	Stocks at end of month
October 1911	52,792	28,692	26,832	55,425	60,267
November	49,945	30,375	29,932	60,307	49,905
December	54,865	29,439	35,374	64,833	39,937

Total, 1911

January 1912	53,272	27,832	35,789	63,621	29,589
February	51,801	25,101	28,191	53,292	28,098
March	56,114	30,128	26,241	56,369	27,843
April	56,011	31,033	23,773	54,809	29,048
May	56,570	32,456	31,030	63,476	22,142
June	54,605	29,321	27,434	56,355	19,792
July	61,233	31,738	26,840	58,578	22,447
August	65,013	35,114	31,467	66,611	30,340

PRODUCTION OF GOLD IN THE TRANSVAAL

	Rank	Else- where	Total	Value
July 1911	Oz	Oz	Oz	£
August	679,881	29,377	709,258	3,012,738
September	682,408	31,002	713,407	3,030,360
October	669,773	30,852	700,625	2,976,065
November	677,923	30,721	708,644	3,010,130
December	291,466	28,267	719,729	3,057,213
Totals, 1911	680,782	29,126	709,908	3,015,499

Totals, 1911

January 1912	709,280	27,780	737,360	3,130,830
February	674,960	28,906	703,866	2,989,832
March	796,755	33,968	830,723	3,528,688
April	706,763	30,897	737,660	3,133,383
May	746,948	32,714	779,662	3,311,794
June	722,588	31,348	753,936	3,202,517
July	735,941	30,397	766,338	3,253,198
August	732,197	32,540	764,737	3,248,395

* Including 70,145 oz. worth £297,946 extinguished reserve.

COST AND PROFIT ON THE RAND

	Tons	Yield per ton	Costs per ton	Profit per ton	Total profit
1911	d	s.	d.	s.	£
January 1912	23,888,260	27	6	18	10 11,414,863
February	2,067,161	27	6	18	10 997,557
March	1,980,396	28	1	19	2 907,192
April	2,163,098	28	1	18	11 2,047,764
May	2,039,562	28	1	18	9 1,005,920
June	2,177,348	28	1	18	9 1,073,534
July	2,110,657	28	5	18	10 1,063,634
August	2,149,785	28	6	18	8 11 1,061,089

NATIVES EMPLOYED IN THE TRANSVAAL MINES.

	Gold mines	Coal mines	Diamond mines	Total
July 31, 1912	181,582	8,122	11,054	200,758
August 31	179,810	8,182	11,292	199,284
September 30	179,619	8,045	11,475	199,139
October 31	179,194	8,078	11,319	198,591
November 30	176,736	8,043	10,071	194,850
December 31	178,282	8,053	8,914	195,249
January 31, 1912	184,046	7,805	9,524	201,375
February 29	190,320	7,922	10,789	209,301
March 31	186,748	8,198	12,071	210,971
April 30	197,937	8,361	13,765	220,086
May 31	198,829	8,460	14,538	216,827
June 30	188,494	8,549	15,530	212,573
July 30	182,922	8,497	15,834	207,256
August 31	179,111	8,706	15,934	203,811

GOLD OUTPUT OF INDIA.

Year 1910	Year 1911	August 1912	Year 1912
£2,104,858	£2,150,050	£188,495	£1,492,678

PRODUCTION OF GOLD IN RHODESIA.

MONTH.	1908	1909	1910	1912
	£	£	£	£
January	199,388	204,666	227,511	214,918
February	191,635	192,497	203,888	209,744
March	200,615	202,157	228,385	215,102
April	212,935	222,700	228,213	221,476
May	223,867	225,012	224,888	234,407
June	224,920	217,600	214,799	226,867
July	228,151	225,334	195,233	240,514
August	230,792	228,296	191,423	—
September	204,362	213,249	178,950	—
October	205,466	222,653	234,928	—
November	196,668	236,307	240,573	—
December	217,316	233,397	199,500	—
Totals	2,536,007	2,623,788	2,568,201	—

PRODUCTION OF GOLD IN WEST AFRICA.

MONTH.	1910		1911		1912	
	Oz.	Value	Oz.	Value	Oz.	Value
January	17,357	70,699	15,903	66,107	26,098	107,262
February	16,976	68,469	15,179	63,081	25,009	102,270
March	17,627	71,954	16,387	67,673	27,228	111,376
April	16,363	67,069	17,237	70,880	27,790	114,796
May	16,590	68,355	24,427	96,409	28,015	115,678
June	17,194	70,988	22,555	91,174	27,784	114,697
July	15,564	58,551	22,010	91,955	30,974	127,800
August	13,921	57,713	25,385	103,753	—	—
September	11,497	47,746	26,717	109,039	—	—
October	13,341	55,046	26,826	109,503	—	—
November	14,021	57,658	24,289	99,299	—	—
December	15,042	61,737	24,369	99,569	—	—

PRODUCTION OF GOLD IN WESTERN AUSTRALIA.

	Export oz.	Mint oz	Total oz.	Total value £
Total, 1910	363,496	1,209,856	1,573,352	6,682,042
Total, 1911	160,021	1,210,447	1,370,468	5,823,522
January 1912	10,697	95,673	106,370	431,528
February	40,441	92,091	102,532	435,526
March	40,898	92,597	93,005	395,058
April	10,698	98,708	110,406	468,972
May	9,288	98,104	107,392	436,170
June	1,214	106,930	108,144	459,605
July	8,802	96,838	105,640	448,728
August	7,262	101,377	108,639	461,466

OTHER AUSTRALASIAN GOLD PRODUCTION.

	1910	1911	August 1912	1912
	£	£	£	£
Queensland	1,840,337	1,623,390	132,170*	566,220*
New South Wales	803,727	769,353	15,360	418,120
New Zealand	1,896,332	1,808,049	68,573	1,001,976
Victoria	2,422,700	2,138,060	225,200	1,337,500

* July figures only.

SALE OF TIN CONCENTRATE AT REDRUTH TICKETINGS

	Tons	Value	Average
Year 1911	61514	£702,599	£114 4 5
Jan. to June 1912	3230	£393,326	£121 14 0
July 8	274	£29,636	£127 3 11
July 22	274	£33,749	£123 19 4
August 6	234	£30,649	£128 2 2
August 14	2614	£38,835	£129 5 3
September 2	2254	£30,433	£134 13 4

EXPORTS OF TIN AND ORE FROM STRAITS AND BOLIVIA
Reported by A. STRAUS & Co

	1911 tons	Aug. 1912 tons	1912 tons
Metal from Straits to Europe and America	55,135	5,205	38,527
Metallic Content from Bolivia to Europe	2,587	1,861	13,741

REVIEW OF MINING

INTRODUCTORY.—Since our last issue appeared, the business of London has been under the depressing domination of that heartless individual the clerk of the weather, who, in these irreverential days takes the place formerly accorded to Jupiter Pluvius. The calamitous season, as *The Times* calls it, has spoiled the summer holidays of thousands of working people and ruined the harvest over a larger part of these islands. Yet it has not wholly damped the ardour of speculators on the Stock Exchange, for Rubbers, Diamonds, and Kaffirs are three departments, at least, in which increased activity has been manifest. Undoubtedly we are a great people; no ordinary humanity could be optimistic on sodden turf under sullen skies; no common temperament could be cheered to the point of buying shares amid these raw days of drizzling rain. If we can conquer this caricature of a summer we ought to be fit to survive for any ordeal, even an Olympiad at Berlin.

Diamond shares have been active on the rumour that the De Beers would swallow the Premier, but the good results from both groups of mines, plus the increasing demand for brilliants on the expansion of industry, will serve to explain a rise in quotations. It is surmised, however, that purchases with a view to ultimate control may be a factor in the improved market position. South African gold shares are better, for several reasons. Low quotations have brought purchasers into the market. General economic conditions at Johannesburg are improving. But the chief factor in stimulating a revival has been the successful development of the Far East Rand, where the Modderfontein group is yielding good results, both in the mill and in exploratory work underground. A further improvement in South African shares would ensue if doubt concerning the

prospects of the East Rand Proprietary could be removed. Copper shares have also been in demand, following upon purchases by New York, where the statistical position is considered cheerful. Undoubtedly the earning capacity of the leading copper-producing companies has been enormously improved by the maintenance of the market at about 17 cents per pound. This has been amply indicated by the letters of our correspondents at New York and San Francisco.

TRANVAAL.—In July the Witwatersrand yielded 735,941 ounces of gold, and the outside districts contributed 30,397 ounces, making a total of 766,338 oz., worth £3,255,198, for the month. The slight increase, as compared with June, is due to the extra day. According to the latest official statistics, the number of producing companies was 65 in May of this year, as against 67 in May of last year; during the year the number of stamps at work has increased from 9978 to 10,073; a gain of 95 stamps. The dividends distributed are in the proportion of £1 for each ounce of fine gold, or about 25% of the gross output. In August the total production was 764,737 ounces, valued at £3,248,395, this being a decrease of 1601 ounces and £6803. The labour statistics for July were much as we anticipated, showing a decrease of 5569 natives, or a little more than the diminution in June. Since April the total decrease has been 15,012, as compared with a decrease of 10,666 during the corresponding three months last year. Now, however, that the harvesting season is at an end, it is likely that the labour supply will begin to improve. The 182,925 natives employed in gold mines in July of this year compare with 181,583 employed in the same month of last year. This affords testimony to the comparative failure of the recruit-

ing methods, and suggests, as we explained in full in June, that the existing sources of supply have been tapped to their limit. In August the number employed was 179,111, showing a further decrease of 3814 during the month.

The assays and widths of ore cut by the shafts of the Modderfontein Deep and the Government Mining Areas afford further evidence of the expansion eastward of the Rand's productive area, but the figures must be accepted as those of isolated samples of the lode. The Modder Deep sample is surprisingly good, while those obtained in the Government Mining Areas are decidedly disappointing. Such early indications are never conclusive. For example, the first of the Brakpan shafts struck a poor patch, far below the average subsequently disclosed in the levels, while the second shaft penetrated exceptionally rich ground, as much above the average as the other was below. We discuss the prospects of the Far East Rand elsewhere.

The City Deep, Village Deep, and New Modderfontein are all in a healthy condition. Geduld, one of the big disappointments, is giving signs of betterment. Brakpan is going strong. The reported purchase by the Central Mining corporation of more shares in the City Deep, Crown Mines, and Nourse Mines is a welcome sign of support to the Kaffir market from quarters the least likely to be misled. The chief seller is the Consolidated Gold Fields, which appears to be gradually liquidating its holdings on the Rand.

From the Luipaard's Vlei Estates the new manager, Mr. C. B. Saner, reports that he has cut 10 dwt. ore for a width of $5\frac{1}{2}$ feet in a cross-cut 200 feet below the 20th level. Since then a sample of the east face has yielded $14\frac{1}{2}$ dwt. over $3\frac{1}{2}$ feet, and the west face 11 dwt. over $3\frac{3}{4}$ feet. As the operating cost is about 17s. 6d. per ton, this ore will yield a much bigger profit than that hitherto in reserve.

The Swaziland Corporation, a Lewis &

Marks enterprise, has received good news regarding its Ivanhoe mine, where, on the No. 2 level, a cross-cut has penetrated a lode assaying 22 dwt. for 14 inches. It is a coincidence that the neighbouring property, the Pigg's Peak Development Co., controlled by Ehrlich & Co., is also opening up well. A telegram informs the shareholders that a cross-cut into the supposed foot-wall just above the 6th level has exposed an additional 14 feet of 10 dwt. gold ore. The significance of this information lies in the fact that the rock hitherto taken for a foot-wall has now proved to be merely a parting in a large lode. The recognition of the true character of the supposed foot-wall rock is due to a microscopic section made at the instance of the new manager, Mr. Charles Hunter, who thus ascertained that the supposed 'diorite' was merely quartzite.

RHODESIA.—The output of gold for July is officially given as 57,122 ounces, worth £240,514. This is the highest total since August of last year, and is due largely to an increase in the number of contributing mines, which was 184, as against 168 in June. Among individual mines, the Lonely Reef shows the largest increase, from 2501 oz. in June to 3716 oz. in July.

We note with regret that Sir Abe Bailey is again taking a hand in Rhodesian affairs, by the purchase of a large block of shares in the London & Rhodesian Mining & Land Company. He is also credited with an effort to obtain control of the Cam & Motor company.

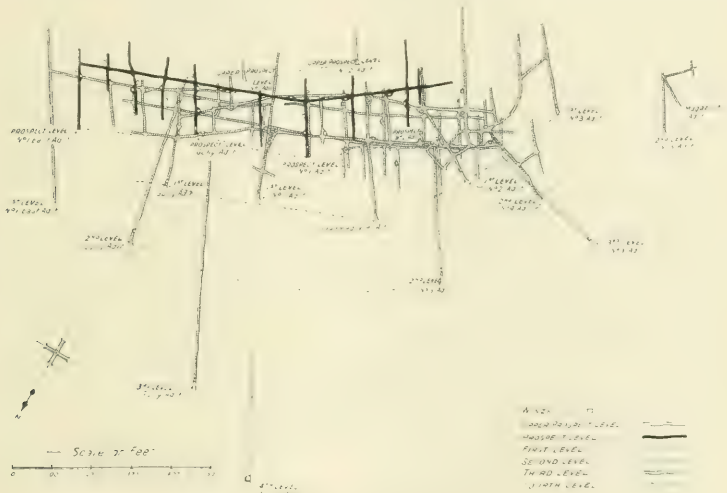
A discovery of quartz rich in gold is announced as having been made three miles north of Gatooma. 700 claims have been pegged. This is the second surface discovery made near Gatooma in less than a month.

A local company called the Pickstone Gold Mines has issued a prospectus at Salisbury. The property is 17 miles from Hartley and has been inspected by Mr. R. W. Pringle, who finds 45,000 tons of 8'32 dwt. ore ready for extraction. The cost of working is estimated

at 10s. 6d., using stamps and Chilean mills. Local opinion is highly favourable to the enterprise.

The Eldorado Banket quarterly report contains detailed figures concerning the richness, length, and assay-value of the ore at the different levels. These figures amply confirm our contention that the claim of progressive

cord with the Rhodesian habit of giving information that does not inform. The plan is difficult to understand, even by a mining engineer, let alone an untechnical person, without a cross-section, if not a longitudinal section also; for the orebody lies within a ridge that is penetrated from both sides by prospecting adits. Moreover, the outlines of the orebody



MAP OF THE SHAMVA WORKINGS.

and continuous enrichment in depth is fictitious. Even an assay-value of +0 dwt. in a winze from the 9th to the 10th level does not "evidence that reef values are being maintained in depth," for as yet only 330 ft. of driving has been done on the 9th, and only 210 ft. on the 10th level, as against 1073 ft. of ore along the 5th level. Winzes are generally sunk at selected rich places. The report is ingenuous but unconvincing. The only new ground opened up on the 10th level is 100 ft. long and averages 6.1 dwt. per ton. This is not profitable.

At last the Shamva Mines Company has given the shareholders a map of the workings. It is inadequate, however, and is quite in ac-

cord with the Rhodesian habit of giving information that does not inform. The plan is difficult to understand, even by a mining engineer, let alone an untechnical person, without a cross-section, if not a longitudinal section also; for the orebody lies within a ridge that is penetrated from both sides by prospecting adits. Moreover, the outlines of the orebody are not indicated. We re-publish it for what it is worth and as an example of how companies can go through the motions of giving information to their shareholders. The quarterly report shows an insignificant increase of the tonnage in reserve; a fact due to the diminution in the extent of the orebody as defined on the third level. The shares at £4 represent an absurd gamble.

WEST AFRICA.—The July statistics exhibit a further increase, the total output being 30,794 ounces, valued at £127,800, as compared with 27,784 oz., worth £114,697, in June. The Abosso and Taquah mines both show a larger production, while the two leaders, the Ashanti Goldfields and the Prestea, maintain their out-

put. The chief reason for the bigger total is the beginning of productive operations at the Abbontiakoon, which yielded £5200 worth of gold. Both of the dredging companies, on the Ancobra and Offin rivers, respectively, report a decidedly larger yield. The figures published by the Chamber of Mines are, it must be noted, not reliable, in so far as regards items of cost and profit, for the so-called 'cost' represents an intermediate stage of book-keeping, and the so-called 'profit' bears no fixed proportion to dividends.

Nigerian tin affairs are quiet, with signs of an effort to revive the market, so demoralized by the Anglo-Continental fiasco. Real work is being done at several of the alluvial mines and results ought to be forthcoming. We hear growls against the mining regulations, bad in themselves, and rendered worse by periodic proclamations changing them without improving them. Referring to the Benue imbroglio, we are informed that the records of the Mines Office contain an application by the late manager, in his own name, for an area adjoining the Benue property. Apparently he had faith in his own optimism.

The Niger Company has appointed a special agent to organize the transport system of the Plateau, including the Bauchi, Zaria, and contiguous districts. He arrived at the mines at the end of July and is expected to accelerate existing methods of shipment, both inward and outward.

The manager, Mr. Arthur W. Hooke, of the Juba Tin & Power Co., reports that he estimates the property to contain 38 acres averaging $7\frac{1}{2}$ ft. of gravel. Allowing 20% for boulders, he finds 375,000 cubic yards averaging 8 lb. black tin per cubic yard. This equals 1400 tons of black (70%) tin. This testing has been performed by means of 126 pits. Hydraulic operations have been started.

CANADA.—We refer to Cobalt elsewhere. Our Toronto correspondent sends the current news. It is noteworthy that the Nipissing Mines

Company is completing the erection of a mill to treat its low-grade ore, of which 80,000 tons is already accumulated on the dump. The plant consists of 40 stamps, each of 1500 lb., and 4 tube-mills. The ore is to be crushed in cyanide solution and then agitated in more cyanide solution before passing through Butters filters. Precipitation will be effected in Merrill presses, the precipitate being melted in the high-grade plant, described in our June issue. Mr. Charles Butters, now retained as consulting metallurgist to the Nipissing Mines, has designed and is supervising the erection of this mill.

The transfer of South African engineers to Canadian enterprise is noteworthy in the case of the Canadian Mining & Exploration Co., which has Mr. William W. Mein as mining engineer, with Mr. Ralph Stokes as his assistant. Mr. Mein was formerly manager of the Robinson, while Mr. Stokes has just resigned his post as one of the underground managers at the Crown Mines. The Canadian Exploration Company has its offices at New York and is controlled by Mr. Ambrose Monell and associates of the International Nickel Co., operating the famous nickel mines at Sudbury, Ontario. This also is the company controlling the Dome mine, at Porcupine, where Mr. C. W. Merrill is metallurgical advisor. The Exploration company has issued 500 shares at \$5000 each, this high par-value being intended to limit speculation and to restrict the number of shareholders. By investing the \$2,500,000 thus obtained in remunerative but safe securities, it is possible to obtain the small amount of money needed for current expenses and the testing of likely properties. Any mine that passes scrutiny can then be floated in a company to which the Exploration shareholders will have the first call. This method is one worthy of consideration, particularly as it is a plan adopted by a group of men widely experienced in mining finance.

INDIA.—Owing to exceptional drought, it

was found necessary to suspend milling operations at the North Anantapur during the early part of August, but regular work was resumed on the 24th. It is announced that the erection of the Butters filter-plant at the Champion Reef mine will be completed by the end of this month. Better reports are to hand as regards the developments at the Hutti (Nizam's) gold mine, a winze below the 1940-ft. level being in ore averaging 1 oz. over 5 feet.

AUSTRALASIA.—The price of lead is so high as to suggest the probability of a decline, but while the metal market remains good the Broken Hill companies are earning big profits, at least twice as large as those of a year ago. Both the North and South mines may be expected to make a further increased distribution of dividends at Christmas. The two zinc companies must have a cheerful day of reckoning at an early date, for they are paying for tailing and increasing their resources. The Mount Elliott copper mine is going through an experience like that of the Mexico of El Oro, the rise in shares being due to enthusiastic purchases in Paris. Results of a temporary character, based on the treatment of a limited tonnage of high-grade ore, have unduly elated our French friends and some of their British coadjutors. Increased interest in Great Cobar is also due to Paris buying, on the belief that the period of difficulties is past. If the present output can be maintained, the rise is justified. The Hampden Cloncurry is to pay a substantial dividend in February; the developments in the Duchess mine are said to be excellent. We comment on another page on the position at Mount Morgan. Mr. G. A. Richard has resigned and Mr. W. H. Wesley, of Mount Lyell, has been appointed chief metallurgist.

We learn that local opinion at Broken Hill is not at all favourable to the British mine, owing to continued doubt as regards the estimate of ore available. On the other hand, local sentiment is decidedly bullish toward the

North and South mines.

At Waihi no change is reported; the strike persists, and water has risen to the No. 9 level. By the way, what has happened to the Geological Survey's report on this district? It looks as if the New Zealand speculators had been able to cause it to be pigeon-holed until the shares had struck bottom. The report was handed to the Government last December yet the Agent-General in London is ignorant of its contents.

The showing at the bottom of the Great Fingall is hardly as good as was expected when the new orebody was first struck, but the north drift on the 18th level has been yielding encouraging results lately, the vein from 105 to 422 feet from the shaft assaying consistently from 9 to 15 dwt. per ton for a width of 4 to 6 feet. The last 25 feet has averaged 12 dwt. for a width of 7 feet.

RUSSIA.—The Atbasar developments continue good. So large a tonnage has been indicated by boring that it has been deemed best to suspend these operations at the copper mines and to employ the drilling machinery for the purpose of testing the further extension of the coal seams at Baikanour. The plans and specifications for the concentrating and smelting plants are being prepared. Not less important than these technical operations is the discovery of a new trail from Djousalee, or Fort No. 2, on the Tashkent railway to Djeskagan, where the copper mines are. This trail avoids the belt of sand that hindered transport along the older route. A road is now being made along the line of this trail.

Returns from the Lena Goldfields still show the effects of the recent troubles. Nor are the underlying causes likely to be removed in a hurry. The wretched quarters, bad food, and brutal treatment allotted to the workmen are enough to provoke persistent unrest and revolt. The pay of 1'30 roubles is not a living wage, even in Siberia, nor is the privilege of retaining nuggets found in the gravel (that is,

the right to steal) worth much to the miners except on the two richest claims, the Feodosievsky and Swietli. Even in these the work is done only by night, because nuggets are too readily detected by the workers in the day-time. As is generally known, the richest ground is being worked and the cost of operations is so high as to be astounding to anyone having had experience elsewhere of drift mining in frozen gravel. Not less than 1500 horses are employed underground, despite the fact that electric power could easily be generated from two rivers in the district. For these anomalies and defects of management the English directors are not to blame, but the unprogressive Russian management, which is in control through the Russian company, the Lenskoie, in which the Lena Goldfields holds a large block of shares.

MEXICO.—We publish an illuminating letter, from a well-informed mining engineer, on conditions in Mexico. Later telegraphic news indicates a renewal of friction along the northern frontier, where occasional bands of so-called rebels come in conflict with American soldiers. This prompts talk of intervention by the United States, but we are assured that President Taft will use every effort to avoid such an irretrievable complication.

The El Oro annual review, issued in advance of the directors' report, shows a steady diminution in the reserves of ore, which now amount to 301,934 tons, having an average assay-value of \$7'46, as against 484,139 tons, assaying \$7'66, a year ago. Owing to the large admixture of old tailing, the extraction in the mill has fallen from 91'56% of the gold to 85'09%. About 378,000 tons of tailing remains to be treated. The railway and lumber departments are becoming relatively more important, for the profit earned by them amounted to \$240,400 during the year.

The Mexico's annual report indicates a maintenance of profits and dividends, and a slight increase in the tonnage of ore in re-

serve. Enough ore is available to maintain the present rate of output for 2½ years, but the developments in depth confirm the opinion that the ore-bearing ground is becoming rapidly abbreviated.

The announcement that the action brought against the Santa Gertrudis Company by Mexican shareholders has been dismissed by the Higher Court is quite in line with expectations. The matter was discussed in our February issue. The litigation arose out of the *avio* contracts, the former owners of the Amistad and Concordia claims demanding an accounting from the present company. No doubt was felt concerning the legal rights of the Santa Gertrudis Company, but the squelching of harassing litigation will be none the less satisfactory to British shareholders. The Santa Gertrudis is now in possession of a controlling number of shares in the plaintiff company and will be able to exercise that control to the further protection of its interests at Pachuca.

VARIOUS.—That ill-fated enterprise, the Dunderland Iron Ore company, appears to be approaching a final crisis, for Krupps, who had provisionally undertaken to subscribe the necessary capital to operate their Ullrich wet magnetic concentration process at the mine, have withdrawn from the scheme, owing to their engineer reporting unfavourably as to the nature and extent of the ore deposit. The company is now in the hands of a receiver in bankruptcy.

An interesting bit of news comes from the Braden copper mine, in Chile, where the preliminary trial of the Minerals Separation froth-agitation process has proved so successful as to warrant an increase of this special equipment from a capacity of 1200 tons to a plant that will treat 3600 tons daily. The first unit will be at work in October.

References are made elsewhere in this issue to the encouraging news from Cornwall and to the expansion of operations in Perak.

EDITORIAL

ACCORDING to the latest census, the population of Canada is 7,250,000. This is slightly less than the population of London.

SPEAKING of luminous tails, is it not rough on the Institution for a member to place F.R.G.S. in front of M.I.M.M.? Fellowship in the Royal Geographical Society does not indicate any particular fitness for professional work. It is a mere frill, of the flimsiest material.

IN OUR LAST issue we advocated some attention being given to instruction in petroleum mining at technical schools. We now note with interest that the curriculum at the University of Birmingham is to include a special course in this subject and that a degree of B. Sc. (Petroleum) is to be granted in future.

OF the many ways in which mining shares may be peddled to the unsuspecting, we may mention that adopted by an American promoter who is selling shares in a copper mine at Whiskey Flat to tailors in London. These pass the 'good thing' to their customers. In future we shall say: It takes nine tailors to make a mine.

WE are glad to see so influential a paper as *The Observer*, when referring to a palpable effort to revive speculation in Kaffirs, saying: "Recent events show that it is a dangerous game to play against some, at least, of the so-called 'magnates.' And if the public prove shy again, these 'magnates' have only themselves to blame. There are decencies in commercial transactions with the public which they have not always observed. More's the pity, since it spoils, to some extent, a whole

industry." This is all true and timely. It is well for the public to avoid buying shares in mining companies controlled by persons or groups that have not only disdained to observe the 'decencies' of industrial finance but have used mining as a cloak for systematic deception. Fortunately individuals and groups exist that have observed all the 'decencies' and are still willing to give the public a run for their money. It is to the companies controlled by reputable financiers and honest operators that we advise the sensible speculator to turn. The more discrimination the public shows, the more likely are honourable practices to oust dishonourable methods.

THE GEOGRAPHIC distribution of, mining operations is well suggested by the contents of this issue. We publish special articles on mining in the Transvaal, Bolivia, and Mexico, besides correspondence from Seoul, Kalgoorlie, San Francisco, Camborne, Johannesburg, Melbourne, and Toronto. In our editorial pages we carry our readers to Alaska, South Africa, Queensland, New Zealand, and Canada. British capital not only irrigates the waste places of the earth but it aids enterprising men in every corner of the globe.

BULLION of unusual purity is obtained in the mill of the Yuanmi Gold Mines in Western Australia by simple, but most effective, methods. Excess zinc is removed from the precipitate, representing the last stage of cyanidation, by means of dilute sulphuric acid. The residue is then washed and filtered before being roasted at red heat for 4 hours, without stirring. This roasted product is then fluxed with a little borax and sand, to be melted in a tilting furnace fitted with salamander or plumbago pots. From these pots, after re-

removal of excess slag, the bullion is poured direct into moulds, the bars from which are shipped without further treatment. The bullion is worth £4. 3s. on average, but assays of 983 parts of gold, 12 parts of silver, and 5 parts of base metal are frequent. Only oxidized ore is being crushed, no attempt at amalgamation or concentration before the cyanidation being made on account of the stibnite in the sulphide ore. Nevertheless, the extraordinary fineness of the bullion is remarkable, especially when it is noted that the zinc shaving is first dipped in a solution of lead acetate.

LABOUR CONDITIONS in New Zealand continue bad. They will continue to be bad so long as the fundamental ideas of the workers are nourished on the reckless talk of the present leaders of the Federation of Labour in New Zealand. We note, by reference to the *Auckland Weekly News*, that at the recent conference at Wellington the Federation advocated "the principle of the 6-hour day" and passed a preamble which begins by asserting that "the working classes and the employing class have nothing in common." They have this in common that many men belong to both and that all men may pass from one to the other. The Antipodean economists proceed to say that "between these two classes a struggle must go on until the workers of the world organize as a class, take possession of the earth, and the machinery and production, and abolish the wage system." Thus the boiler would assert its superiority to the engine, and the machinery of civilization would become idle for evermore. Further wild assertions are made, and then the workers are invited to reject the conservative motto of "A fair day's wage for a fair day's work" for the new watchword: "Abolition of the wage system." And so forth. All of which is pitiful when it is not damnable. We yield to none in sympathy with the real working man and we are quite prepared to second the request

for "at least 10 hours between shifts," "one day's rest in seven," and any other way in which the brutality of manual labour may be made humane, but, as former managers of mines, we recognize the unreality of the rhetorical hot-air that is driving the workmen of New Zealand to a stupid attack on one of the workman's chief privileges: the right to work, which is at least on a par with the right to be idle.

RECENT LEGISLATION by Congress compels newspapers in America to declare who controls them. It has been enacted that they must file with the Post-Office twice each year a statement of the circulation and the names of the managers, besides a list of the shareholders or the name of the proprietor. We welcome such a law. It may prove difficult to enforce, but as an expression of public opinion it is already worth something, as setting the seal of approval on the papers that do declare their ownership and control. In technical journalism we have long discarded anonymity even among contributors, believing that the readers are entitled to know the name and qualifications of the writer who undertakes to tell them anything important on mining and metallurgical matters. Similarly, in regard to the control, we believe that a frank declaration of ownership places responsibility where it belongs, and tends to prevent the misuse of the Press as an organ of public opinion. *The Mining Magazine* is controlled by a private company, consisting of 32 shareholders, all mining engineers or metallurgists, mostly in London. The majority of the shares is divided between the Editor and the Business Manager, who also constitute the directorate.

AS A LURE for advertising patronage, many of the London daily papers publish, at weekly or fortnightly intervals, a few columns of 'Engineering Notes.' Some of the writers of these notes may be properly quali-

fied men, but others are merely the blind leaders of the blind. For instance *The Daily Telegraph* of September 2 informs us that "mining stamps are now driven by compressed air, twelve of these recently having replaced the old-fashioned Cornish stamps at the Dolcoath tin mine in Cornwall." Our only comment is that if engineers used the name 'air-cushion' stamp, instead of 'pneumatic' stamp, thus following the nomenclature adopted by the makers of this type of machine, there would be no possible excuse for misapprehension as to the nature of this particular application of air-compression. But this is not the only error in the paragraph mentioned, for it also states that "On the Rand pneumatic stamps are largely used." In the words of a famous humorist, this report is greatly exaggerated. There were a couple, we believe, on the New Kleinfontein, but they are not now in use. Our non-technical contemporary may, however, be credited with an accidental anticipation of events, for these stamps are gaining in favour.

AMONG our subscribers are men in the most out-of-the-way corners of the world; in places so remote that ordinary banking facilities, as expressed by cheques, are lacking. Hence we have received subscriptions in the form of gold-dust from Alaska, or postage stamps from China, the sender forgetting that foreign stamps are not legal tender in London. In a letter from Colombia we received a piece of rolled gold, with the following:

"Enclosed you will find a leaf of pure gold, weighing 5 grams, valued at approximately 14s. Being anxious to receive your Mining Magazine I would be greatly obliged if you would forward me the said magazine to the extent that the value of the gold leaf will allow. I do not know the exact amount of your subscription rate. I have heard a lot about your magazine, and I am anxious to get it."

We sent the gold to Mr. Arthur C. Claudet,

who reported that it was 979 fine and was worth 11s. 10d., that is, sufficient to pay for nine issues of the magazine, inclusive of postage to Colombia. However, we appraise the message from our worthy friend in terms other than fine gold and hope that the technical information published by us from time to time may help him in finding a plentiful supply of the precious metal, without loss of health but with increase of happiness.

REGRET is often expressed that the United States wins so large a share of the trade in machinery imported into the British Dominions overseas. This regret has been given formal expression in *The Times*. In a recent issue that representative newspaper quotes the Board of Trade returns, which show that the total average exports of machinery during five years, from 1907 to 1911, amounted to £23,821,600 from the United States and £30,721,311 from the United Kingdom. Turning to details, we find that the mining machinery exported from the States was worth £1,461,976 in 1911, as against £1,034,503 exported from our own shores. Despite the high cost of the raw material and of labour, the United States more than holds her own, by reason of "the adaptability, resource, enterprise, and persistence which characterize the American machinery builders." So says *The Times*. These are qualities not unknown in Great Britain; they need only to be encouraged and cultivated. Our facilities for transport, our business connections, our political ties with the overseas Dominions are all such as to give us a reasonable advantage, if only backed by the necessary initiative. An example instanced by *The Times* is worth quoting: We exported £26,188 worth of typewriting machines last year, as against £2,037,186 exported from the States. Is not this a pitiful contrast, having regard to the increasing use of this particular kind of machinery? No wonder that obsolete methods

of writing and copying are still used even in the City of London; such methods as would be considered archaic in a frontier town either in Australia or America. In these and other matters we need to rid ourselves of a complaisance and slackness that cripple every effort to progress in the competitive industries of the world.

IN a recent 'mining notice' it is announced that the manager of the New Brilliant Freeholds Gold Mining Co. has cabled saying: "One foot of nice mineral stone, No. 14 level east, not yet through." This mine is at Charters Towers, in Queensland, and we know something of the Australian vernacular, therefore we infer that a foot of well-mineralized ore has been cut in the east drift on the 14th level, but we wonder what the ordinary British shareholder could make out of *sò* bucolic a phrase as "nice mineral stone." Of course, 'stone' is an Australian provincialism for 'ore'; it is one of the terms, like 'reef' and 'paddock,' introduced by sailors and carpenters in the early days of the gold 'rush.' Nobody uses 'stone' as a synonym for 'ore' except the Australian. Nobody, even in Australia, ought to use it, as it fails to be descriptive save to the illiterate miner. Further, it is obvious, or it should be obvious, that the quartz in a vein at Charters Towers must be a 'mineral.' Used as an adjective it is meaningless. The French say that quartz is *bien mineralisé* when it is rich in sulphides, and we have adopted the term from them, saying that quartz is well mineralized. As for 'nice,' in such a context, it is worthy of the innocent young person to whom expressive terms seem brutal. The Australian will speak of 'good-looking stone,' of 'rich gold,' of 'good gold,' and uses a variety of rudimentary jargon that is out of a place in the terminology of mining, which, after all, is an art based upon the application of science. All such localisms and crudities should be avoided, if not killed outright, for they hinder

the intelligent exchange of ideas between the various English-speaking peoples.

MANY THINGS in America excite our cordial admiration, but the newspapers of that great country are not among them. From American journalism of the Hearst and Pulitzer type we pray to be saved. Signs are not wanting, however, that yellow journalism threatens to throw its jaundiced tint across the London Press, of which hitherto we have had good reason to be proud. When *The Times* prints a 'Woman's Column' edited by Harrod's, it is time to protest. The piffle concocted by the advertising agent of a department store is neither fit reading matter for a great newspaper nor can the weird process of manufacturing such flapdoodle be called 'editing.' Similarly Selfridge's disguises its advertisement in the *Pall Mall Gazette* by inserting a reading notice of sublimated drivel. Such performances are the flagrant signs of an insidious custom by which advertisers contribute reading notices masquerading as the reasoned opinion of a specialist. Of such are the so-called engineering supplements of the *Daily Telegraph* and *Times*. The matter printed alongside the advertisement columns in these cases is simply a sop to Cerberus.

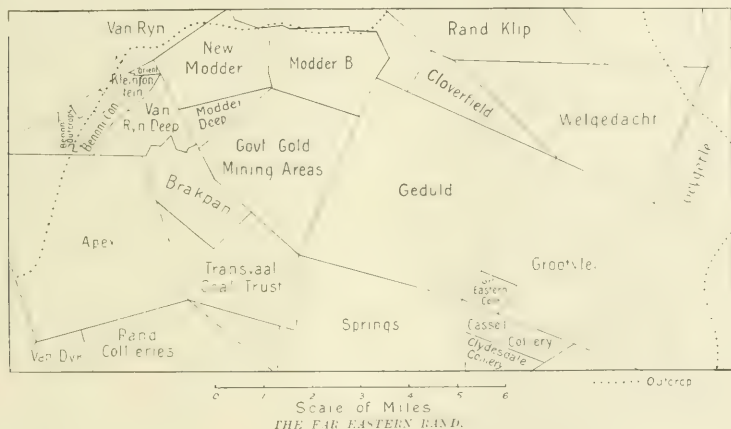
The Far Eastern Rand.

The recent revival of speculative interest in South African mining shares has been stimulated largely by the successful development of a group of mines in that part of the Witwatersrand district called the Far Eastern Rand. This outlying portion of the great gold-field was first surveyed and examined for coal. One of the earliest investigators was Mr. Charles J. Alford, who, fully 25 years ago, indicated the probability of a persistence of the gold-bearing conglomerate under the coal measures. However, the geological probabilities suffered neglect for many years, despite the notable early successes achieved in the

immediate area covered by the Chimes, Modderfontein, and Van Ryn. It was ascertained by prospecting operations in the East Rand Extension and adjoining groups of claims that the Main Reef series is faulted east of Boksburg to such an extent as to confuse the identification of the various seams of 'banket' found beyond this geological dislocation. Such ore as was discovered in the course of early prospecting in this locality proved unprofitable, for the 'leaders' or thin layers of con-

by the spasmodic efforts of the Geduld, which quite recently has shown signs of renewed promise. Finally, the Modderfontein Deep and the Government Gold Mining Areas sunk bore-holes and shafts that yielded results sufficiently unlike to kill hasty generalizations.

Among the earlier ventures were the Apex and Benoni. Of these two, the Benoni is said to retain some promise, a promise that gains confirmation from the results achieved by the Brakpan, which is on the dip below the Be-



glomerate that were traced in a painstaking manner, by shafts and boreholes, contained too little gold to compensate for the broken character of the ground. However, after the Van Ryn West and the Van Ryn Estate companies had come to grief, a consolidation of them under the Van Ryn Gold Mines Estate was effected by the Albu brothers, acting on the technical advice of the Denny brothers. The decisive success ensuing marked a new departure in the development of this portion of the Rand. The Modderfontein and then the Kleinfontein were similarly successful, and in later days the Modderfontein B. and the Brakpan confirmed the productive character of this part of the district, although, in the interval, the record had been slightly disfigured

by the Benoni. This relation, however, has scant economic value because the ore-shoots have no definite pitch, but exist in the beds of conglomerate as patches of irregular shape and dimensions. Furthermore, the Brakpan occupies a subordinate syncline converging from the Benoni, Modderfontein, and Geduld. Geologically, therefore, the territory owned by the Brakpan is characterized by structural conditions that are peculiarly favourable. Owing to the flatness (about 5°) of the dip, it has been practicable for a shaft only 3700 feet deep vertically to cut the lode at a distance of three miles from the outcrop, or twice the distance of the deepest development on the Central Rand, where the Main Reef series has an average dip of about 30 degrees.

On leaving the faulted area in the East Rand Extension claims, the Main Reef series makes a big bend southward into broken ground owned by the Apex company, and then sweeps northward again, through the Benoni, into the Modderfontein, where it becomes highly productive. Beyond the Modderfontein the continuation of the ore-bearing series has been projected on paper in accord with a variety of theories, but, despite vigorous drilling and other prospecting, nothing of importance has been achieved. It is conceded by geologists that the Nigel group of mines at Heidelberg covers an extension of the Van Ryn or Main Reef series, but the effort to prove this theory by profitable mining on the curving line traced between the Modderfontein and the Nigel, has hitherto proved abortive. Here we have an excellent example of the application of geology to mining. The new science can be applied to the old art in diverse ways, of which it is the mining engineer's duty to select the one that yields economic results. The establishment of correlation theories is not uninteresting, but it is merely an academic victory if it does not lead to the discovery of ore sufficiently wide and sufficiently rich to be exploited at a profit. By intelligent observation, reasonable inference, and careful prospecting, the engineers of the Rand have added enormously to the extent of profitable mining operations on the Main Reef series, as traced to the eastern limits of the known productive area. The success there achieved will encourage them to further effort. That effort finds justification in the favourable conditions disclosed by the work recently reported. The Modderfontein Deep cut the lode at 2990 feet on August 2, finding an average of 10 feet of 8'84 dwt. ore. Of this, more than 4 feet is waste, much of which can be sorted. On the Government Gold Mining Areas, adjoining the Brakpan on the east, the first shaft cut the lode at 2395 feet vertically on June 11, exposing 2½ feet averaging 7 dwt. per ton. In a second

shaft the lode, cut on August 18, was found at 2275 feet, assaying 4'71 dwt. over 20 inches, and in faulted ground. These results differ widely, for whereas the Modderfontein Deep has proved the existence of a big width of profitable ore, the Government Gold Mining Areas has obtained evidence that is merely promising. The widths exposed in the shafts are insufficient for stoping, and if the assay-value be expressed in stoping-widths it sinks below the economic limit. However, these results must not be regarded as representative, for they come from isolated samples which may be bettered when the workings have been extended into ground that is less disturbed by faulting. Meanwhile, it is important to remember that the flattening of the strata in this portion of the Rand renders it possible to reach the ore at such a depth as to facilitate the rapid development of a large area. It remains to be seen whether the Far East will redress the balance of the Witwatersrand goldfield; in any event, it will prove a decisive factor in retarding the decadence of the premier goldfield of the world.

Cobalt.

Excessive richness of ore usually coincides with non-persistence of the vein or lode in which such ore is found, for Nature has an eye to compensation and dislikes placing too much of a good thing at one spot. Specimen ore is not fancied by experienced miners because they fear that such ore, apart from loss by theft, is likely to prove ephemeral. It is probably short-lived because it is obviously extraordinary. The phenomenal is necessarily unlikely to continue. On the other hand, ore of medium grade and for a full stoping-width of four or five feet represents economic conditions highly favourable to profitable mining while not so exceptional as to awaken anxiety on the score of continuity. Such ideas undoubtedly influenced the hesitation shown by experienced operators going to the great silver-

mining district of Ontario when it was first discovered, and even those who had enough curiosity to visit the locality were prejudiced by the uniform narrowness and excessive richness of the veins of silver-bearing calcite. However, Cobalt has made a record that proves Nature's occasional departure from precedent. The small rich veins have been shown to be big and persistent enough to make a dozen dollar-millionaires. The smallness of the veins has been compensated by the number of them and by a yield of silver large enough to render exploitation remunerative beyond the expectations of the timid speculator. From the discovery in 1904 to the end of 1911, the district of Cobalt has produced 126,064,189 ounces of silver. Last year the output reached its maximum, namely, 32,000,000 ounces, but it is apparent already that the current year will improve upon that record. The character of the ore is suggested by the fact that on December 29, 1911, the Temiskaming Mining Company shipped a car-load weighing 60,676 pounds, or slightly more than 30 tons, containing 200,337 ounces of silver, worth \$117,287; again, on February 5, 1912, the same company shipped another car-load weighing 50,850 lb. or about 25 tons, containing 202,806 ounces, valued at \$117,962. In 1911 the Nipissing Mines produced 4,678,074 ounces of silver from 2914 tons of ore. The romantic story of the early discovery of this great mine was related in this magazine in October 1911. Up to the end of 1911 the company owning the Nipissing property, which includes 846 acres, had uncovered 158 veins, of which fully 50 have been productive. Since then a method of stripping the surface by means of hydraulicking has led to the discovery of a large number of additional veins. The mine has paid \$7,850,930 in dividends to the end of last year, on a capital of \$6,000,000 in \$5 shares. Other famous mines are the Coniagas, La Rose, Temiskaming, and Crown Reserve.

The silver is found in small stringers and

occurs mainly in metallic form associated with white calcite. Sulphides and antimonial sulphides of silver are also common. The arsenides and sulphides of nickel and cobalt add to the complexity of the ore. In places the enrichment spreads laterally from the thin veins into the encasing rock. The high-grade ore is sorted and broken in the stopes, so as to be ready for bagging at the surface. The poorer ore mined at Cobalt was at first discarded, and later was sent to the concentrating plants, when these were built. Subsequently the slime was cyanided. Now the use of cyanidation has been extended until, in the new Nipissing low-grade mill, no concentration is to be attempted, save preliminary jigging at the mine. The combination of cyanidation and amalgamation as applied to the rich ore was described in our June issue. Thus the metallurgical methods are being developed so as to render profitable a class of ore that was rejected not many years ago. This improvement has coincided with a clearer comprehension of the geological conditions. Stated briefly, the veins traverse the conglomerate and other fragmental rocks of the Huronian division, overlying the basement series of the Keewatin. Intruding them is a sill of diabase. At first the veins were supposed to persist indefinitely in depth; then it was feared that they were superficial; now it is known that the disposition of silver characterizes the veins when they are in the diabase, but it also continues for a short distance where they extend into the adjacent rocks. The diabase is 500 feet thick, so the ore-bearing zone is about 1000 feet thick. Owing to erosion the limit of profitable mining varies at different localities within the district. It rarely exceeds 500 feet in depth. But within this zone the chances of finding ore are multitudinous. The recognition of this fact has stimulated systematic prospecting, increased the output, and lengthened the life of the individual mines, as well as that of the district as a whole.

In Mexico.

We publish another article on the political position in Mexico, for the interest in the mining industry of that unhappy country warrants a timely record of the progress of events. The article appearing in this issue is written by an American mining engineer intimately acquainted with both the past and present history of Mexico. He shows how the spectacular character of Orozco's revolution, and the nearness to the Rio Grande of the scene of that leader's operations, has caused it to overshadow the revolts in Puebla, Morelos, Guerrero, Oaxaca, Durango, and Tepic, where uprisings of the *cacique* type have harassed Madero since his quarrel with Orozco. Nevertheless, although Orozco's forces have been defeated and scattered, they still engage so large a part of the Mexican regular army that the Government has been unable to send a single regiment to Guaymas, by way of Manzanillo, to stop Orozco's retreat into the highlands of Sonora. He has taken to the hills, with a following still sufficient to flout the local administration. It has been rumoured recently that secret negotiations for peace are in progress between Madero and Orozco. The report ought to be true, for it is obvious, even to a tyro in military affairs, that Orozco's leisurely retreat proves the weakness of the Government's position in the North. Any settlement, however, is likely to bring with it a new embarrassment, for Orozco is likely to demand a post of some honour and profit, an appointment that would tend to discredit Madero both at home and abroad, and also encourage other upstarts to fight their way to political preferment. Such a method of ending revolutions is quite common in Spanish-Indian countries, but it has no finality. Only a resolute policy on the part of the Government can end the disorders. These are quieted, for the moment, in the North by the recapture of Juarez, but they have been revived into sanguinary activity in the South.

The followers of Zapata, the worst of the bandits posing as reformers, recently attacked a train at Cuautla, murdering a large number of non-combatants. At Ixtapan also a massacre of inoffensive inhabitants followed the capture of the town. Other desperadoes have been looting and murdering under the cover of warfare in other parts of the country. Confidence in the ability of Madero to quell these many insurrections has not departed, but it is time for him to show the strong hand. The better-class Mexican has been negligent of his duty to the Government, but he must realize by this time that the defeat of Madero would entail a reign of terror or a series of revolutions such as would kill established industry. The creation of a new army has been authorized and the money required has been obtained, but the dilatoriness habitual in the land where it is always afternoon has caused this means of ensuring peace to be long forthcoming. The Federal troops, which first fought for Diaz against Madero, and then for Madero against Orozco, Zapata, and Salgado, have proved themselves both loyal to the Government in being and also good fighters. This augurs well for the new army. Votes and legislation are excellent in their way, but the maintenance of order, by the policeman or the soldier, is the first evidence of civilization.

Mount Morgan.

Among the mines that have at some time worthily held the first place among the great gold mines of the world is the Mount Morgan, in Queensland. Although a large part of the profit now earned comes from its production of copper, the mine still ranks as an important contributor to the general stock of gold. We note with pleasure that the report of the financial year, ending on May 31, exhibits an increase in gross revenue and in net profit. The total production was 351,858 tons of ore, yielding 7440 tons of copper, worth £409,200, and 134,575 ounces of gold, valued at £481,943.

Of this, 91,946 tons, yielding 2068 tons of copper and 718 ounces of gold, came from the Many Peaks mine, a subsidiary or annex property more than a hundred miles distant from the parent mine and acquired two years ago. Though primarily intended as a flux in substitution for the barren oxide of iron hitherto employed in smelting operations, the Many Peaks ore promises to add considerably to the copper output. If the contribution from this source be subtracted, the preponderance of gold production at the Mount Morgan itself becomes more marked, the yield from the original mine last year being 4520 tons of copper, worth £248,600, and 133,857 ounces of gold, valued at £568,792. We note with interest that the reserves of ore have been re-estimated. A direct comparison with the previous statement is not possible, owing to a difference in the assay-value taken as the basis for classification. The reserves are divided into two classes; of the richer ore in 1911 there was 1,543,000 tons, averaging $3\frac{1}{2}\%$ copper and 8 dwt. gold per ton, as against 1,499,000 tons of $3\frac{1}{2}\%$ copper ore averaging 10 dwt. per ton in 1912. Of the second-class ore there was 2,070,500 tons carrying 3% copper and $2\frac{1}{2}$ dwt. gold in 1911, as against 2,027,000 tons carrying $2\frac{1}{2}\%$ copper and 5 dwt. gold in 1912. Making a rough calculation, it would appear that there is available 3,526,000 tons of 2.9% copper and 7 dwt. gold ore in 1912 as compared with 3,613,500 tons of 3.2% copper and 4.9 dwt. gold ore in 1911. From these figures it is obvious that the assay-value of the ore in reserve has been largely increased by the higher gold content. Since the acquisition of the Many Peaks mine, the smelting operations at Mount Morgan have caused trouble and anxiety to such a degree as to induce the directors to seek advice from the metallurgists at Mount Lyell. On their recommendation the chlorination plant has been abandoned, and the whole of the ore is now smelted on a pyritic basis. The history of the

Mount Morgan may be divided into four stages, each marked by a different metallurgical process. Originally, in 1886, the big outcrop of oxidized ore was treated in a 25-stamp mill, but with scanty success, as the gold was not docile to amalgamation. Thereupon a barrel-chlorination plant was built, giving a much higher extraction at a slightly greater cost. As the hill was penetrated by deeper workings the gozzan gave place to a silicious gold ore charged with copper pyrite. This ore was roasted and chlorinated for the extraction of the gold, while the copper by-product was recovered as precipitate. When the proportion of sulphide increased it became advisable to erect a copper-smelting plant. This was done in 1905. For several years these various plants were operated concurrently until, two years ago, the oxidized ore was exhausted. Now chlorination is to cease and the beneficiation of the ore is to be effected entirely by smelting. Thus ore chiefly valuable for its gold is being treated mainly as a copper ore. While writing of the chlorination process we may add that the efficiency of this plant has long been doubted by the well informed, and the directors have helped to foster this incredulity by omitting to publish figures for the content of gold in the ore treated. Possibly the fact that in future a better extraction will be effected in the furnaces than in the chlorination vats has encouraged the directors to increase the estimate of gold in the ore reserves; for these assay-values may have been estimated on the basis of extractable content, as is the case with most of the Cornish tin mines. As regards the future, we venture to express a hope that the margin between income and expenditure will be substantially increased. There is certainly room for such an improvement. It is remarkable that a large and rich mine presenting no serious mining or metallurgical difficulties should only make a profit of 8s. 10d. per ton from ore yielding gold and copper worth 53s. 3d. With the new smelting arrangements

and the abolition of chlorination, we expect to see a notable decrease in the cost of operations at Mount Morgan, and a consequent increase in the amount of money available for dividends.

Mining in Frozen Ground.

In summer it is pleasant to consider frost as a geologic agent, and it is also timely to do so because the extraction of gold from frozen gravel has become an important branch of alluvial mining. Those of us who live in a temperate climate have learned to regard frost as the evidence of an ephemeral variation of temperature connected with seasonal changes, but there are parts of the earth's surface where the frost reigns supreme, that is, the summer thaw is superficial, while the frozen condition of the ground extends for several hundred feet vertically below the surface. It is the sequel to a Glacial period, that is, a time when the winter cold exceeds the summer heat, so that the ground is never loosened from the bond of ice. Such a condition once extended over the larger portion of the northern continents; they were then covered under a blanket of ice, which, on a milder climate supervening, retired to the north, leaving the surface once more exposed to the mollifying influence of the sunshine. In his invasion of the waste places of the earth the miner has gone to the northern valleys of Alaska and Siberia, finding gravel deposits rich in gold but frozen solidly. With an ingenuity that is never long baffled he has proceeded at once to thaw the gravel, so that it may become amenable to the washing operation whereby the particles of gold are collected. When the Yukon was invaded in 1898 by a horde of excited gold-seekers, they found that the pioneers had developed a simple method of unloosening the gold in placer deposits. They placed a bundle of sticks on the ground and made a fire that melted the frozen gravel. Then with pick and shovel they dug a hole. This hole, as the re-

sult of more thawing and picking, became a shaft, which, finally, by aid of a rough windlass and bucket, reached to the bedrock, where lay the richest deposit of gold-bearing sand. This might be at a depth of 10 or 20 feet, but it might be as deep as 100 feet. Later, by using more elaborate methods, a depth of over 200 feet was attained, for instance, at Fairbanks. The ground was frozen all the way, that is, the moisture in the ground had turned to ice, cementing the gravel.

In those first winters the valleys of the Klondike and its tributary streams presented a picture worthy of Gustav Doré! There was no noise, for there was no machinery; there were no whistles to announce the noon hour or the evening rest; there was no drilling in hard rock nor cheerful hammering. A weird silence brooded over the waste of snow. The gloom was thickened by a pall of smoke escaping from holes in the ground, whence issued an occasional figure. The flare of fires parting the twilight marked the beginning of the work of shaft-sinking. Not many of the workers were visible, for most of them were below in the rabbit warren of their diggings. At the top of a shaft, here and there, a weary gnome might be espied turning a windlass and emptying buckets from a small pit beneath. The snow, the moss, and the fog muffled every foot-fall, deadened every sound. It looked like hell—but it was freezing.

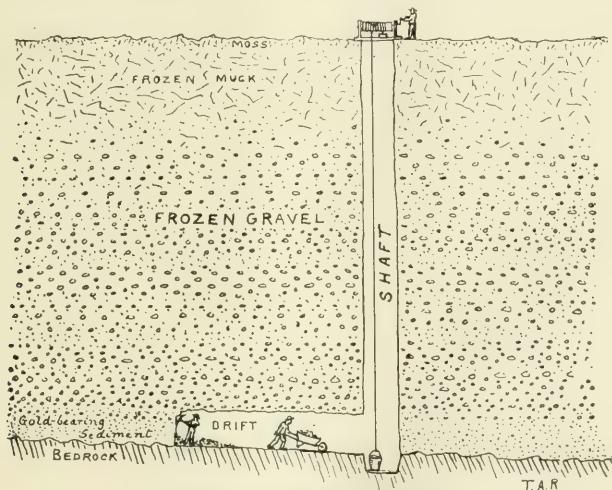
In the Yukon, as in parts of Siberia, such as the Bodaibo, the gold was first found in the running stream, but only where it exposed a part of a former channel. The rich layer of gravel marked the bed of an earlier river system now buried under the detritus spread over it by the floods of a later geologic period. The sinking of shafts to reach this old river-bed and the excavation of the rich gravel on bedrock by means of underground galleries is termed 'drifting.' A 'drift' mine is an underground alluvial mine. In sinking a shaft through the overburden of barren, or nearly

barren, flood-gravel, it is customary in temperate climates to encounter water and soft ground, necessitating both pumping and timbering. In frozen ground neither is required, so that the frost, at first a serious obstacle, proves a real friend to the miner in the North. It enables him to sink a shaft even in the bed of a creek; it permits him to dispense with timbering; it allows him to burrow with safety and to follow the layer of golden gravel with impunity under the ice-bound surface. More-

ly as it affects the dredging operations, now in full swing in the valley of the Klondike.

Dangers of Inexperience.

A financial contemporary publishes a plaint from a correspondent who inveighs against the sending of "inexperienced youths fresh from mining schools" to Nigeria "at the instance of consulting engineers." This protest is well founded and we concur in it, not only in the public interest but for the sake of the young



SKETCH OF A DRIFT MINE IN ALASKA.

over, it obviates work on a large scale. One man can, and sometimes does, work alone, descending the shaft, filling the bucket, ascending to the surface, hoisting the load, and so forth. Ordinarily men work in pairs, as partners. No machinery is needed save the simplest tools; no organization is required, beyond a willing partner; no capital, save muscle. Thus in its early stage of development the exploitation of frozen alluvium exemplifies the application of the simplest principles of mining. In a subsequent issue we shall describe the growth of later practice, in the application of steam to thawing, particular-

men themselves, whose reputations are prematurely blasted by their undertaking to perform work for which they have had inadequate training. Many of the egregious blunders that have temporarily discredited the young mining industry of Northern Nigeria are due to the fact that companies have engaged fledglings at £300 per annum and then exploited their opinions as if they had emanated from veterans at £3000 per annum. In other cases firms of consulting engineers of high repute have been engaged to report and have done so by deputy, sending some youngster to pass judgment upon a form of mineral exploration that

requires ripe experience. Indeed, we believe that the system whereby engineering firms undertake to send some one else to inspect and then accept responsibility for the report is highly dangerous. The personal equation is so large a factor in the appraisal of mines that it is rarely safe to give opinions at second-hand. It is, of course, commercially profitable to depute young men to examine mines for an established firm, for this allows of several retainers being accepted concurrently at a handsome margin; in the end, however, it is, we believe, detrimental to the reputation of a firm, and frequently injurious to its deputy, who makes the blunders of inexperience and is checked at the beginning of what might otherwise prove a promising career. We refer to the matter without compunction, for the practice of deputizing, if carried too far, as seems to have been the case lately, is hurtful to all concerned, namely, the engineering firm, the inexperienced engineer, the public, and the mining industry.

Efficiency.

The newspaper discussion on British participation in the Olympic games, coming as a result of the experience at Stockholm, is not without its moral. That moral is the need for specialization in modern life, whether in athletics or industry. Our way of playing games may be the best, as we think it is, but if we are invited to compete with people who play those games in a different spirit and according to rules to which we are not accustomed, then let us either decline the invitation, or, if competing, let us accept the result without demur. The same idea holds good in professional and business life. Many of our compatriots are prejudiced against our American friends because the latter do not do business according to the accepted British way, and they think to overwhelm the other fellow by saying that he does not 'play cricket.' Well, he does not; he plays base-ball. Cricket may be a prettier

game than base-ball, and the spirit that pervades the cricket field may be more to our taste than that ruling over the base-ball diamond, but there is a proverb: "*Chacun à son gibier et le marchand vend tout.*" Indeed, standing between two friends, as it were, and having heard their confidential expressions of opinion, as to the queer way in which the other fellow does business, we conclude that our own people are too apt to expect others to play a game or to do business in their own way, and if it be done in the other fellow's way, then they do not hesitate to label it as 'unfair,' 'ungentlemanly,' or 'unsportsman-like.' To be frank, we think the British idea of games is the best and that the American idea of business is the best. Unfortunately the American brings his intensity and concentration into sports only to spoil them, and the British introduces his casual indirection into business only to bungle it. It seems to us possible to make the best of both worlds, sport and business, by taking them in a different way: one joyously and without too much emphasis on the competitive aspect, the other seriously and with a full appreciation of its inevitably gladiatorial character. Coming nearer home, it is notorious that our promoters will undertake to finance almost any enterprise, from soap to rubber, from cocoa to mining, without any idea that they ought to have special knowledge of the particular industry involved. They acquire that knowledge subsequently at the expense of the shareholders. Hence the directors of mining companies may be proconsuls of empire, retired generals, admirals on half-pay, anyone with some claim to distinction in a walk of life entirely foreign to the work in hand. Yet we wonder why such boards of directors are inept and unpractical! We expect in mining, as in other affairs, to give scope to our national bulldog tenacity; we hope to muddle through in the old-fashioned way. But it won't do. The times have changed and we must change with

them. The versatility of a Leonardo da Vinci is medieval; this is the day of the specialist. The shoemaker must stick to his last; the modern world has no use for the Jack-of-all-trades, least of all the gentlemanly bungler whose courteous manner almost disarms criticism. In competitive athletics, although not in sport, we need a specialist who differs only from a professional in being more scientifically trained; in the intense competition of business, we require a concentration of the human faculties upon a particular branch of the world's work, so that it may be performed efficiently. Efficiency, personal and national, is demanded, if we are to hold our own in the arena of modern life. Keep your cheerful in-consequence for games, if you will, and refuse to play with others who do otherwise, if you like; but in business, which is no longer provincial or even national, but international, you must face the facts of existence and apply to it the intensity that some people call American but we call splendid.

Coming still nearer home, to the mining profession: when our graduates go forth to begin a career, they do their work fairly well while on duty, but as soon as 'tools are down' they play tennis, polo, or golf; in the evenings they talk of the day's games and of those to be played on the next opportunity; but our typical American young man is reading or studying; in his odd moments he discusses technical problems and in his spare hours he ruminates on the realities of engineering. We exaggerate purposely in order to establish a contrast, which may not always be obvious, but the difference is palpable enough to anyone who has lived with the apprentices on the staff of a mining company. We agree that something is lost to life by the hard intensity with which the young American applies himself to learning his profession, and we like the picture of our young engineers on the polo-field or the tennis-court, but the brutal fact remains that the competition of modern life is

wide and intense; those who expect to win in the international rivalry of a professional career cannot afford to fritter away the golden moments of early training. From the social point of view, the quiet and casual pose of the cultured Oxford graduate may indeed be more admirable than the assertive and forceful attitude of the technical youth from Kalamazoo; but life is not a drawing-room; it is an arena. The Oxford young man at 22 may appear to be the *fine fleur* of our civilization as compared to his kinsman from the strenuous West, but when each is 35 or 40, the former may be glad to accept a job from the latter. Again we exaggerate in order to illustrate the extremes of tendency. The moral is that efficiency should be the first purpose of the engineer. Relaxation comes after work. Polo and golf should wait for a leisure that has been earned, not stolen, from working hours.

Coming to a later stage, why is it that so few of our British friends specialize? In London, for example, how few are the men who can claim expert knowledge and experience in a particular branch of mining or metallurgy, such as economic geology, copper smelting, or dredging. We have many accomplished men with a wide general knowledge of the technology of mining and metallurgy, but it is a lamentable fact that, outside of cyanidation, the British operator in mines is compelled much too often to call for the advice of a specialist, not a foreigner, it is true, for he is an American, but yet not one of his own immediate people. Of course, we recognize no national distinctions in the mining profession; the only test is efficiency; yet from the standpoint of training it is worth while again to point to the shrewdness of our American friend, who has appreciated the economic value of specialization, and its commercial value also. We advise every one of the graduates from a School of Mines, whether at South Kensington or Berkeley, to absorb the general instruction of their student days with

the fixed purpose of acquiring special proficiency in some particular branch of mining as soon as they have served their apprenticeship. Not universality, but particularity, is the keynote of today. In short, returning to the simile of the Olympiad, if we intend to play the game only among ourselves, we can have our own social conventions and train as slackly as we please, but if we are to go to Stockholm or Berlin, if we are to engage in competition with other nations, we must accept unfamiliar and even disagreeable conditions, conforming to them when necessary and preparing to meet them with a sincerity that leaves no chance for defeat. As Mr. Dooley has pointed out "if ye ate a hearty lunch iv veal an' ham pie, with a chunk iv cheese an' pastry," you cannot expect to beat a competitor who has been willing to forego the fleshpots while in training for the race. Of course, the true amateur may disdain to miss a meal in order to run faster than his fellow-man, but life is not made for amateurs, and those who are proud of being 'professional' men should at least imitate some of the intensity, earnestness, and specialization that enables the professional golfer to give the average amateur the handicap of a stroke per hole. The day of the amateur foonzler in business and technology is gone.

Illiterate Technology.

The spread of technical education has been hastened, in some cases, to the detriment of the sub-stratum of culture that every engineer should possess. We are impelled to make this observation by noticing how often men that ought to know better will use words of Latin origin so incorrectly as to indicate a lack of even a smattering of the classics. For instance, it is a common blunder, especially among young American engineers, graduates from famous universities, to write of 'stratas' and to speak of 'this data,' as if they had never heard of the singular of these plural forms. Perhaps it is invidious to mention

our American friends as culprits, seeing that 'stratas' appeared twice in the transactions of an institution of mining and metallurgy published in the metropolis of the British Empire, but it is undoubtedly a fact that the blunder is more common among American technical men than among Britishers. The latter make other blunders, quite numerous. We impute the use of such illiteracies as 'stratas' and 'this data' to the fact that the American college-man spends the larger part of his early manhood amid the rough environments of the mine and smelter; his work brings him constantly into association with miners and other worthy but uncultured workers; and thus he unconsciously apes the modes of expression employed habitually by those among whom so much of his time is spent. Carefulness of speech is regarded as rather effeminate and exact writing as a mere frill. Hence lapses that may become disgraceful. For such they are. If a man who rightly claims to be a graduate from the Columbia School of Mines, for example, writes 'stratas' and talks about 'this data,' then he does disgrace his Alma Mater, for his speech suggests evidence of the lack of a university training. However, such errors are made by our own men also. A clever young engineer wrote recently concerning the 'foliæ' in the schist of a well-known mining district, as if 'foliæ' were the plural of 'folia.' We have seen manuscript in which 'leaser' has appeared where 'lessee' was meant. 'Leaser' is a corruption of 'lessor,' the man who grants, not the man who receives, the lease. Here again it is the illiterate miner whom the educated engineer is imitating. It is worth while to be on guard against such imbecilities. We mention them not without feeling, for they greatly disfigure the writings of men of distinct technical ability, to whom a careful use of the means of expression should be at least as obvious as the correct sharpening of a drill or the proper pointing of a pick.

SPECIAL CORRESPONDENCE

News from our own Correspondents at the principal mining centres

SEOUL.

Korea has always been a favourite field for investment in the Far East, so far as Americans are concerned, and there are those who feel that the United States should have extended a protectorate over the country years ago. However, it fell to Japan, which had the greater need and is making excellent use of the opportunity. Under the new administration, American enterprises in Korea, including a number of mines, are prospering and the early anticipations of friction have largely disappeared. The premier enterprise is the Oriental Consolidated Mining Co., which, while it now operates under an English charter and is managed from New York, is a concern in which there is much interest in San Francisco. The president, H. C. Perkins, is an old Californian, and as the Oriental Consolidated has long been a training school for young engineers and metallurgists, there are always Californians on the staff. Recent advices credit the company with a production of \$778,100 in the first six months of 1912. In the fiscal year that closed July 1, 1911, the total receipts were \$1,541,346, and the operating profit was \$701,488. In that year the Kuk San Dong plant for cyanidation of concentrate, designed by A. E. Drucker, was put into successful operation; and Mr. Drucker is now busy building a re-treatment plant at Taracol. The Oriental Consolidated and the Chosen Mining Co., which latter concern is now building a modern stamp-mill, have contracted with Okura & Co. for electric power. A new plant is to be built at Shinanchu by this firm, representing the Allgemeine Electricitäts Gesellschaft of Berlin. The capacity is to be 3000 kw. and Fusum coal is to be burned. Completion of the Mukden-Wiju railroad makes this feasible. It is estimated that enough ammonium sulphate will be obtained as a by-product (from which a coking-plant and gas-engines is inferred) to pay for operation.

The Chosen Mining Co., which last year was organized to succeed the Morris-McGary partnership, and which has the Kosung mine in the Yeng Byen district, is credited with an output of \$280,840 for the first six months of the year. It is expected that when the new plant, which is under the superintendence of Willis Lawrence, formerly manager at the

Florence-Goldfield, is in operation, the output will be rapidly increased. The ore is free-milling and the reserves were estimated at the close of 1911 at 300,000 tons averaging \$5 per ton. The company also holds the Wha



San, which is considered good property. Stock in this company put on the market last July at par, \$5 per share, is strongly held. The original issue was over subscribed and shares have sold up to \$30. J. D. Hubbard is metallurgist for the company.

Another Korean-American enterprise in which San Franciscans are largely interested is the Seoul Mining Co., controlled by the

Collbran-Bostwick syndicate, the concern that introduced trolley-cars to Koreans, to the great delight of the latter and the no small profit of the promoters. The Seoul Mining Co. operates mines at Suan, in the Hwang Hai Do province. The 40-stamp mill was completed in 1909, and in 1911 crushed 70,229 tons of ore from which an average recovery of \$7'85 was made at working cost of \$3'01. The net return for the year was \$339,884, and at its close the reserve included 211,400 tons worth \$499,000. During the year one 30% and one 15% dividend was paid and \$20,000 written off for depreciation. So far the company has paid \$220,000 in dividends on a capitalization of \$500,000 and its prospects for the future are most excellent.

The Chiksan Mining Co. is another concern in which Americans are interested, G. R. Gerry, of the American Electric Co., being president, and G. A. Bagnall, of the same concern, vice-president. The company has the concession in North Ching Chyong province, formerly owned jointly by the Korean Exploration Co. and the Shibusawa-Asano mining partnership. The concern is interesting as being a joint American-Japanese enterprise. It has a well situated concession covering 270 square miles, covering both quartz and placer mines. A central power plant is to be built and a cyanidation mill is under construction.

Americans are not the only ones interested in Korea nor does the above exhaust the list of good mines. The French have a good property at Tungchang and are now supplanting the native mills with a modern plant. The English have properties with which your readers are doubtless familiar. The Japanese are beginning to take a hand directly. The Mitsui Bishi company has gone into iron mining and has contracts for delivery of ore to Wakamatsu, and the Mitsui Bussan Kaisha, it is now announced, is to work the gold mines in Kaichow district, South Pyongando province. It is also said that a Mr. Yasukawa is to open a gold mine at Changsong in North Pyongando province. The total amount of gold produced in North Pyongando province in the first six months of 1912 is placed at \$1,114,363. Of this 70% was purchased by the Bank of Chosen at Seoul. Altogether, mining in the ancient Hermit Kingdom is doing excellently.

Korea is far ahead of Japan in gold production. According to an official report, the total amount of Korean gold exported during the first half of the year 1911 was 6,350,140 yen. During the same period gold ore in addition to the value of 119,422 yen was exported. The

total amount of gold produced in Korea during half a year is greater by over 300,000 yen in value than the annual output of Japan. The Korean miner is probably the best native miner in the world, all considered, and he seems to take to mining naturally. Prospecting is active and the Mining Bureau receives numerous applications from foreigners, Japanese, and Koreans. There are many virgin goldfields in Korea yet, and in the opinion of men acquainted with the country there will be a mining boom when the facts are known.

KALGOORLIE.

Kurnalpi.—During the past two or three weeks there has been some excitement here owing to two rich finds at Kurnalpi, in 1894-1896 the scene of the richest alluvial finds in this State. First of all Routledge and Graham brought in 718 oz., the largest piece weighing 48 oz. This was won from a leader at a depth of 40 ft. A week later Gessner and Huffa brought in 410 oz., the largest piece weighing 230 oz. This lot was found only 4 ft. below the surface in a similar leader 2½ miles north. Both parties have been working for over 12 months with varying success, but this is the first gold of any consequence so far unearthed. The banking of the first lot received no special notice, and several parties who visited the find pooh-poohed it. The second discovery, coming so soon after, and at such a long distance as 2½ miles from the first, caused quite a rush to the district. Fully 100 miner's-rights were issued, and some 1500 acres applied for within a few days, and three or four times as much has been pegged. As the Government collects about £10 per block of 20 acres for rent and fees, and newspapers charge 10s. 6d. for every block advertised, a lot of money is changing hands. About 16 years ago the Octagon Explorers, Ltd., of London, sank 6 or 7 shafts to various depths down to 100 ft. and did a good deal of exploratory work in the effort to find the source of the gold, most of which was in big nuggets. After spending a large sum of money, they abandoned the task as hopeless. At that time R. S. Black, now manager of the Kalgurli, was attorney and general manager for the Octagon Explorers. The find is barely 60 miles north-east of here, and can be reached by motor-car in 3 or 4 hours. Every manager in the district has visited the locality, and most have acquired an interest on the off-chance, but none of them appear to be sanguine. That further rich nuggets will be found is probable, but so far no definite lode has been uncovered. In one claim a kaolin deposit, said by enthusiasts to be worth

variously from 14 to 25 dwt. per ton for 40 ft. wide, has been located, but ordinary dollying fails to reveal any gold. The near future will settle the question, as there is enough local money forthcoming to test the ground thoroughly, near the surface at least. If the Adelaide stock-brokers take a hand in the game, a wild gamble, such as took place at Bullfinch two years ago, may ensue, and injure the State more than ever.

Mount Jackson.—At the time that Gerald W. Williams, on behalf of *The Times*, was deprecating everything in the Yilgarn district, Charlie Jones, prospector of the Bullfinch, advised D. L. Doolette to acquire the Great Unknown at Mount Jackson. A syndicate of nine shares was formed, of which Mr. Williams had one-sixth, but he quickly sold his interest to his partners. No crushing was practicable until quite recently, as the mine is 109 miles from Southern Cross. However, the Government eventually patched up the old Mount Jackson battery, which had been idle for ten years, and the first return from the Great Unknown yielded £5690 from 303 tons, exclusive of residues. A dividend of £300 per share has been paid. There is said to be 1000 tons of similar ore available above the 60-ft. level. Several other shows, including the Bullfinch itself, derided by Mr. Williams, will prove his fallibility. The Bull Ant and Bullfinch East, unfortunately palmed off on London, were unstintedly condemned by the entire local press, and even the prospectors, who sold them, were amazed to find what splendid geese their ugly ducklings had become on reading the prospectuses issued in London.

[Mr. Williams, like the rest of us, may be fallible, but the record of the Bullfinch affords no proof of it. On the contrary, his criticisms are proved to have been fully warranted. Our correspondent forgets that the Kalgoorlie newspapers are not read in London, as we have a few of our own, and he overlooks the principal factor in unduly magnifying the Bullfinch district, namely, the reckless speech of the Premier of Western Australia on October 26, 1910.—EDITOR.]

Labour.—Although a month's notice has to be given by either side to terminate the industrial agreement, which will expire by time on September 30, the labour leaders appear to have taken no action in the matter, and the rank and file appear to have lost all interest in it. The bogey at present is the 'Dago,' meaning the Southern European. The question of limiting his employment on the mines, and in the timber and firewood industry, has been

seriously debated in Parliament. An appeal was made to the Chamber of Mines by the labour organizations, but a curt reply was given, stating that mine managers only employed Dagos when suitable British labour was unprocurable. The Mayor called a meeting in the town-hall during the week, but not a single



responsible labour leader was present, and the meeting proved a fiasco. The Dago is employed, and will continue to be employed, in ever-increasing numbers, the deeper the mines become, as the Britisher objects to working, especially shovelling and the like, at depths of 2000 to 3000 ft. The Golden Horse-Shoe is always short of men for the above class of work and recently got a consignment of some 30 immigrants through Government aid. The experiment was an utter failure, as the youths imported were physically unfit to tackle the

job. Even newly arrived Irish navvies have left after one shift. The fact is that the number of ton-trucks to be filled per shift per man is so great that only the strongest Britisher, Italian, or Austrian can tackle it. Wood-chopping is the same. Few Britishers stick to it a day longer than they can help, as not many, even by working from daylight to dark, can earn £3 per week, and only the champions earn four to five pounds regularly, and living in the bush is no joke.

[We hope some of the mine managers or consulting engineers at Kalgoorlie will discuss the labour position. We shall be glad to publish their views. The humane and efficient employment of workmen is one of the first essentials of successful mine management.—EDITOR].

SAN FRANCISCO

Californian petroleum production in the first six months of 1912 showed a substantial increase over that for the corresponding period last year, despite the fact that no phenomenal gushers have been 'brought in.' The detailed figures of gross output in barrels are as below:

	1912	1911
January.....	7,627,258	6,566,110
February.....	6,893,452	5,978,206
March.....	7,289,498	7,089,955
April.....	7,208,672	6,929,337
May.....	7,333,180	7,113,460
June.....	7,327,830	6,694,078
	43,679,890	40,371,146

At the end of June the total amount of oil in storage was 44,919,262 bbl. If the production continues at the present rate through the remaining months of the year the total output will be about 87,000,000 bbl. It is worth recalling that this is just about the amount produced by the whole of the United States ten years ago and is but little less than the total production of Indiana to the close of 1910. The world's output of petroleum now amounts to about 300,000,000 bbl. and California alone produces more than any country except the United States. At present there are 5374 wells producing and new ones are constantly being 'brought in.' Consumption is slowly increasing, but seems unlikely to overtake production so long as the present amount of drilling is conducted. The Producers' Transportation Co., which now has an 8-in. pipeline from the oilfields to San Luis Obispo, 60 miles, is to lay an additional line, doubling the present capacity of 25,000 bbl. per day. Court

action relative to the Bell ranch near Santa Barbara has terminated; the property is to go to W. P. Hammon and associates, who, it is said, are passing it on to London clients. The ranch covers the extension of anticlines that have proved productive and profitable, and prospecting has shown that the oil extends into the property. The U.S. District Attorney has finally taken action to prosecute those who entered upon Government lands subsequent to the presidential proclamation of withdrawal in 1909. This is intended to test the validity of the withdrawal order and the suits will be most effective in clearing disputed titles.

Business seems to be better in all lines of metal trades. For the first half of the year the output of the furnaces has increased over that for the same period in 1911 approximately as follows: pig iron, 17%; spelter, 18%; copper, 17%. No figures are available for lead, but corroding plants are crowded with orders, electrical and building trades are busy, and prices have been steady, therefore the demand for lead has presumably increased with the others. The report of the U.S. Steel Corporation for the quarter ended June 30 exceeded the most sanguine expectations. Nominally it showed net earnings of \$25,102,285 as against \$17,826,973 for the first quarter of the year. Allowing, however, for the effect of a new form of statement, the actual figures are \$20,027,146, on the basis of former statements. Earnings of \$42,928,238 in six months still leave the corporation shy \$6,285,657 of the sum needed to meet dividends, bond interest, and depreciation on the liberal scale that has previously been allowed. The profits are none the less amazing for a period of moderate to low prices, and in considering them full account should be taken of the water-logged nature of the corporation; a condition brought prominently before the public by the Stanley investigation.

Copper production continues to increase despite the now admitted fact that the metal is accumulating at the mills and in the refineries. No exact data are available, but it has been roughly estimated that 80,000,000 lb. is thus held out of the apparent surplus. If this be true it would seem that the syndicate now managing things in the copper world has sold current production at an increased price at the expense of adding to the 50,000,000 lb. said to have been taken off the market when the movement began. While brokers continue to talk of a possible shortage of copper and of higher prices, consumers have refused to place advance orders at present quotations and there

is a general feeling that 17 c. per lb. is too much to pay. It is true that not many big copper properties are preparing to come into production as was the case ten years ago, but on the other hand there are many that are not working up to full capacity and there is a quiet confidence that increased recovery will shortly add to the output of existing plants. Aside from that, it is true that those who talk loudly of the absence of copper properties have been somewhat spoiled by prosperity and refuse to consider anything except a mine of the largest size. The time seems ripe for the quiet entry into copper mining of new men; those content to operate mines of modest size and without ambitions to "repeal the law of supply and demand."

In the meantime high prices for metals, while reflected in high prices for stocks less directly than presumably was hoped by insiders, has made a good market for mines. At Butte there is a lively scramble for territory and among the buyers Lake Superior men are prominent. It is a well established rule that Butte property sells well in the Lake country and Michigan shares always have a market at Butte. The two great copper regions are connected by many ties. Mining claims which have been regarded as next to worthless for several years in the northern part of the Butte district are bringing high prices. The Ready Cash claim, which a year ago could have been secured for \$10,000 or even less, recently changed hands for \$110,000, there having been \$10,000 paid in cash with an agreement to pay the rest in a year. The Narragansett, which was sold a few years ago for \$2'64 at sheriff's sale to satisfy delinquent taxes, is now under option for \$75,000, while there are several other instances of claims selling all the way from \$80,000 to \$135,000, which a few years ago could have been secured for the payment of the taxes. This boom was started by A. B. Wolvin, president of the Butte & Superior Copper Co., and John M. Hayes, of the Utah Copper Co., purchasing claims adjoining the Butte & Superior property. Then Duluth people secured options, and the furore to secure claims spread. Prominent among the people who are buying up claims is Chester Congdon, and he is said to have associated with him Thomas F. Cole. Mr. Cole and his associates have six claims just east of the North Butte and north of the North Butte Extension, and have options on other claims in the vicinity, although no record has yet been made of an agreement for a sale. Bruce McKelvie, of Hayden, Stone & Co., is said to

be carrying on negotiations of some kind for the financing of the Butte & London Copper Development Co. There is also a report that an effort is being made to finance the Butte & Bacorn M. Co. and resume development.

Gold mines as well as copper territory are in demand, and, in harmony with developments in copper, the property most sought is



The Alaska Perseverance Mill.

that which promises expansion into a large low-grade mine. Last month it was noted that the Alaska Perseverance and adjacent properties had passed under the control of B. L. Thane and W. P. Hammon. It is now announced that Hayden, Stone & Co. has undertaken to finance the venture, on the advice of

D. C. Jackling and A. F. Holden. The properties are now owned by the Alaska Gastineau company, which is capitalized at \$12,000,000 and has \$3,500,000 outstanding in bonds. An 80% interest has been taken under option by Hayden, Stone & Co., and placed in the treasury of the Alaska Gold Mines Co., a holding corporation. It is proposed to expend \$5,000,000 in development and equipment. A long adit will be necessary to tap the lode at depth and to bring the ore to the 6000-ton mill which is to be built at sea-level below Juneau. The lode is large and the gold is present. As the grade is low, nothing but large-scale operations is likely to be profitable, but the capitalization of the new company may be criticized. Remembering that the Treadwell has outstanding no bonds, and shares to a par value only of \$5,000,000, the amount seems excessive. It is reported, however, that the engineers estimate a return of \$1,500,000 per year from the Alaska Gastineau properties, equivalent roughly to 10%. This is practically the same as the net operating profit of the Alaska Treadwell for 1911.

Tin has reached and maintained such a high price that attention is widely attracted to any reported discovery of tin ore. The Alaskan deposits seem just now to afford the most hope of establishment of a local industry. It is known that tin occurs at several points in the Black Hills of South Dakota, but there was so much fraud and loss in the attempt made some years ago to mine it, that it is difficult to get serious attention even to the best prospects. Last year Ledoux & Co. of New York spent some time investigating the Black Hills tin veins but nothing tangible has as yet resulted. Near El Paso, in Texas, there are tin veins, and in 1911 a few pigs of block tin were made and shipped. It is the opinion of a number of competent engineers that an active underground search for workable orebodies is amply justified by the surface showing. Unfortunately, the owners have preferred to build a plant rather than open ground, and so, after a short period of production, the enterprise is at a standstill. Lode tin has been mined a little near Spokane, Washington, and on the Seward peninsula, though with no great profit. Stream tin, on the other hand, was dredged on Buck creek last season with good results; 90 tons of concentrate was saved and shipped to England. Arrangements have been made for its treatment this year at Tacoma, Washington, and a satisfactory business seems to have been established. The fortunate owners are San Francisco men. Success here has

naturally stimulated search, and near Hot Springs the stream tin, long known to occur, has been traced by painstaking work to a lode crossing the heads of Sullivan, Tofty, and Idaho gulches. The ore occurs in connection with a dike described as rhyolite. This has been followed for 10,000 ft. The lode itself is in the hanging wall and has been found by cross-cutting and trenching to be 12 ft. thick and 3700 ft. long.

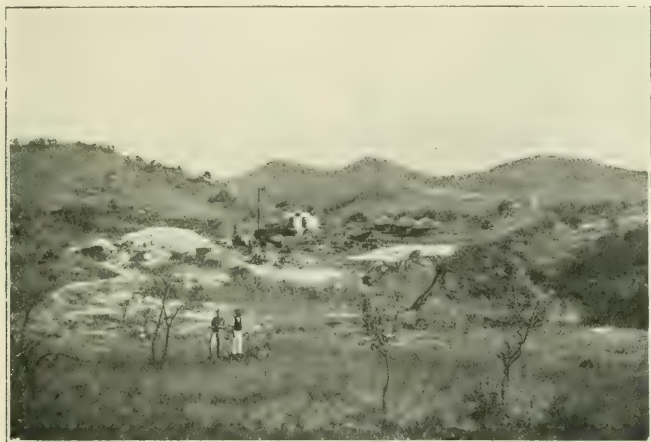
JOHANNESBURG.

Premier Diamond.—During July, the Premier Diamond Company established a wonderful record in hauling and treating 1,000,000 loads (16 cu. ft.) of ground. Converted into units of weight, this represents an output at the rate of approximately 10,000,000 tons per annum. This vast tonnage is treated in the No. 3 (pan) gear and in the newer No. 4 (pulsator) plants in the ratio of about 5:7. The depth of the benches from which the bulk of the No. 3 ground is being drawn is 210 ft., while No. 4 gear is secured largely from the deeper level of 260 ft. Between 16,000 and 17,000 natives, including an exceptionally high proportion of Basutos, are now at work on the property. As the extensive introduction of small hammer-drills is contemplated and a new type of jockey for the endless-rope haulage is to be used, providing for automatic on-setting and knocking-off, the tonnage broken and hauled per boy will soon be largely augmented and the company placed technically in a more independent position. In spite of attractive working conditions, the Premier has suffered from its labour troubles no less acutely than the gold mines. It is surprising that work in the open air, even for a shift longer by two or three hours, does not prove more popular to native labourers, especially as the piece-work system in the diamond mine enables the skilful 'boy' to gain high wages.

Metallurgical Ideas.—Whatever criticisms may be aroused by the inaugural address of J. A. Yule, the newly elected president of the S.A. Institute of Engineers, a lack of courage will not be among the faults attributed to it. The respective spheres of work belonging to the mechanical engineer and the metallurgist upon the Rand are so vaguely defined as to cause frequent 'boundary' disputes in the domain of experimental metallurgy. Fortunately, the feelings of professional jealousy or pride rarely find public expression, for, after all, any appeal concerning the precise subdivision of work between mechanical engineers, metallurgists, and min-

ing engineers can only be made to the employing firms, who rightly care little whence progressive ideas may arise if they can be successfully adopted. Mr. Yule, representing the mechanical engineers, clearly declines to recognize that metallurgical methods lie without the proper scope of his society's activities, and his spring address was largely devoted to the problem of future metallurgical progress. His remarks embody many ideas that have been frequently expressed before and many that have been common talk without having gained public exposition. He said: "It is quite possible that today more economical and efficient means of coarse crushing could be

tion of hypothetical flow-sheets below the breaking and crushing plant proved too fascinating, and further led him to the dangerously controversial theme of 'all-sliming,' a subject laden with troubled memories. "To reduce water requirements further and at the same time accelerate the extraction of gold, I see only one reason why the cyanide solution should not be introduced in place of water at the crushing rolls. . . . All amalgamation would be abandoned if the above system were adopted. . . . The capital cost would be considerably less, besides which there would be a great reduction in attendance, power, labour, and repair costs. . . . More tube-mills would



A TYPICAL SMALL MINE IN RHODESIA.

used (than by gravity stamps) to supply the product required by the tube-mills. I have no first-hand data to work upon, but I think that two or three-stage crushing could be introduced, the product from the last stage being cubes of $\frac{1}{2}$ inch and less; this product to pass through rolls, the rolls to crush to the fineness required by the tube-mills, say, to pass a screen having 9 or 12 holes to the square inch." Mr. Yule considers that joint trials should be made with rolls having shells of different varieties. Water requirements would be advantageously reduced by the proposed scheme. Mr. Yule deserves credit for pointing to lines of mechanical research that may be followed with benefit, but, unfortunately, the mental evolu-

tion of hypothetical flow-sheets below the breaking and crushing plant proved too fascinating, and further led him to the dangerously controversial theme of 'all-sliming,' a subject laden with troubled memories. "To reduce water requirements further and at the same time accelerate the extraction of gold, I see only one reason why the cyanide solution should not be introduced in place of water at the crushing rolls. . . . All amalgamation would be abandoned if the above system were adopted. . . . The capital cost would be considerably less, besides which there would be a great reduction in attendance, power, labour, and repair costs. . . . More tube-mills would

be required on account of the coarseness of the product being increased, but even allowing for the additional power required for tube-mills and crushers used in conjunction with the rolls, there would still be a saving." The only drawback to using cyanide in place of water at the crushing rolls is held to be the danger of loss. Another disadvantage, demonstrated years ago, but which Mr. Yule now ignores, is the consequent difficulty of accurate sampling and valuation. The use of cyanide further precludes the employment of efficient amalgamation below the tube-mills, the abandonment of which cannot be so simply justified as is implied by Mr. Yule's casual disposal of the question in eleven words. On the contrary,

the vexed questions raised by the president of the Engineers' Institute being so essentially wrapped up in the special studies and labours of the metallurgist, it is unfortunate that they have been revived in this general manner without any convincing illustration of the exact lines on which the knowledge of the mechanical engineer can be of service and of the spirit of co-operation, instead of control, in which that special knowledge will be contributed. In any case, these problems are of too long standing and have been made, in one phase or another, the basis of too many solid debates to allow any superficial discussion before a body of mechanical engineers to be productive of practical results.

Benoni-Apex.—The lucid report made by C. D. Leslie of the Consolidated Gold Fields on the probable reef contents of the Benoni and Apex mines, now published, brings to light no facts of a surprising character. Judged solely by position, these mines would be instinctively branded as a 6 dwt. combination (mine-grade). The result of Mr. Leslie's calculations gives the lower figure of 6'0 dwt. for milling grade, *after sorting*, for 18,800,000 mill-tons, allowing 58% 'payable' in the Benoni and 65% in the Apex. The fluctuating distribution of gold, characteristic of the Far East Rand, prevails in the Benoni-Apex area, and it is thus interesting to see how the Gold Fields engineers, previously little interested in this part of the Rand, accordingly frame their estimates of recovery-value. Omitting second and third places of decimals, the estimate gives 80% at 6'0 dwt. from ore reserves; 6% at 3 dwt. from development faces; and 14% from other sources at 4'5 dwt., giving, with 0'3 dwt. residue, a yield of 5'3 dwt. or 22s. 2'7d. per ton. This allowance of 14% from other sources means a great deal in its bearing on current questions of Rand working policy. It represents a mill-tonnage of not less than 3,000,000 tons of a value that yields no profit, if we apply the standard pay-limit without qualifications.

A Wholesale Policy.—The reasonable explanation given of this 14% contribution to the mill can only be interpreted as a direct admission of the inapplicability of a selective or highly discriminative policy of working to this area. Mr. Leslie writes: "The ore is characterized by fluctuations in value over short distances. On this account, though it will be possible sometimes to stoppe around unpayable patches of reef which may be encountered, it will happen frequently that such patches will be stopped through, wholly or partially, so as to

advance stoppe faces to richer ground beyond. There is evidence also that stretches, not always disclosed in development, of foot and hanging wall ore of low-grade, which can be dealt with at a profit, will be met with and mined as stopping proceeds. In addition, it might be anticipated that from blocks of ground previously excluded from ore reserves, as unpayable, small areas of payable reef will be discovered and mined."

Administrative fashions appear to be once more in a state of transition; the period of tight-lacing and hobble skirts is terminating, in favour of more rational freedom. Though favouring the spirit in which this big tonnage of lower-grade ore has been thrown into the stock, as a discounting factor if nothing else, I feel that a little fuller explanation of its component parts would have added beneficially to the significance of the statement. The "patches" of low-grade ore scarcely bear on the question, for, surely, the basis of ore-reserve valuation allows for them already. Every 6 dwt. block inevitably contains "patches" of 3 dwt. rock as it does "patches" of 9 dwt., and the omission of them, if practicable, would merely tend to raise the theoretical grade of the reserves. These patches are part and parcel of the ore reserves, as calculated, and should therefore not figure in the 14% low-grade allowance. They make up the usual monthly figure of 'unprofitable' material from profitable blocks of ore, recorded in all mines. It is from the other two sources that the 3,000,000 tons must therefore be derived, namely, problematical foot-wall and hanging-wall ore, and from unprofitable blocks, presenting limited faces of profitable ground. Both these sources of supply are easily avoidable (excepting where a false 'hanging' occurs) and would only be touched as the result of a deliberate policy. A year or two ago it would have been rank heresy to recognize them as prospective sources of ore-supply, until the ore reserves proper had been exhausted and the mine caved beyond hope of their profitable redemption.

New Underground Contract.—At the time of writing, there appears every prospect of the Transvaal Miners' Association persisting in its noisy disapproval of the new form of mining contract, whereas the great majority of the men, as much puzzled by the changed form as by their leaders' denunciations of it, are agreeable to accepting the conditions under mild protest and to giving it a distrustful trial. Only a few provisions in the new agreement involve any material change in the position of the contractor, although its expression

in legal terms gives it an aspect of increased severity, while the offer of minimum wages, made by most of the companies, should be regarded as an earnest of an honest desire to introduce less speculative conditions into the contract system. The leaders of the Association are making keen efforts to rally the men, and are undoubtedly gaining many recruits and arousing fresh enthusiasm among old members, whose subscriptions are sadly apt to fall into arrears under a peaceful sky. But there appears little fear of sufficient animosity being excited over the new form, seemingly so complex in its bearings and so variable in its application, to bring the industry within view of another strike. Like the mining Regulations, the new agreement depends upon the spirit of its interpretation and many mine managers—to the Association's annoyance—have effectually assured their men that their interests will not be affected adversely by signing the standard agreement. In reality, the only standardization effected along the Rand, so far, has been in the scale of charges made for stores and native labour, which are reduced to cost price. This general reduction has involved a corresponding reduction in contract rates (calculated as closely as possible to leave earning-capacities unchanged), which are, however, no nearer to a common 'standard' than they were before. The balance of the agreement is simply a legal tool for the enforcement of businesslike control over a business undertaking. There is at present a lack of unanimity between mine managements as to the application of certain clauses (notably, the guarantee of minimum wages per shift), and consequently it may be taken for granted that there will be no uniformly severe interpretation of the provisions in the agreement. No manager today can afford to lose good men. In times when there is rivalry for the services of experienced miners, there is most need for such co-operation among employers as will check suicidal competition in wages and contract rates; but there is then also the greatest difficulty in getting uniform agreements strictly observed. When the mines are in an admittedly healthy condition and the danger of phthisis is reduced to a practical minimum, the Rand will attract an adequate supply of skilled labour, and, what is more important, will hold that supply in a state of advancing efficiency. Then will the time be ripe for the introduction of standard contract schemes or of the better system of bonus and day's pay, which will bring the earning capacities of miners within more reasonable limits of vari-

ance and will still allow an average rate to be maintained, in excess of those in force in any other settled mining district in the world.

TORONTO.

Cobalt.—During the last few weeks interest in the Cobalt silver mines has been increasing, while Porcupine has attracted considerably less attention. A large number of old mines and prospects in the former district that had been closed-down have been reopened, or are being examined by prospective purchasers, and there is a general revival of activity. This was given a somewhat sensational turn by the opening, to prospectors, of about 4000 acres of the Gillies Limit, lying to the south of the Cobalt area, on August 20. This territory had been examined by officials of the provincial Bureau of Mines without any valuable discoveries having been made; nevertheless the announcement of the opening drew large numbers of prospectors from all the northern mining camps, many of whom were on the ground for days in advance. The earliest time for staking was directly after midnight on the morning of the 20th, when about 2000 men struggled for the opportunity to stake 200 claims. A wild time had been anticipated, with serious rioting and violence, but the reputation of Canadian mining camps for preserving order was well maintained, and though disputes, as might be expected, were numerous, no serious trouble occurred. After the staking there was another scene of excitement at the recorder's office in Haileybury, where the applicants made a rush to secure precedence in recording. As it afterwards turned out, they might just as well have spared themselves this trouble, for it is announced that in cases where two or more applications are made for the same claim, the property will be awarded to the claimant submitting the best proofs of an actual discovery without regard to priority in recording. Such cases are numerous; in one instance there are no fewer than eight applications. It is doubtful whether any of the eager prospectors have secured anything of value, as the claims on the portion of the Limit previously sold by the Government at an aggregate figure of over \$400,000 have yielded no profit to the investors.

The Preston-East Dome company, which despite its ill luck with both its Porcupine ventures still has funds in hand, has taken over the Silver Bar property at Cobalt on a working option and begun active operations. The Airgold which has been idle for several years is being worked by the Cyril Lake Mining Co.

The Foster, formerly a dividend-payer, but closed-down for some time, has been unwatered and is being examined by the Flynn syndicate, of New York. The Cobalt Central, now known as the Penn-Canadian, has shipped a car-load of high-grade ore from the 110-ft. level, and has a large body of milling ore at the 300-ft. level. The mill is being re-fitted to treat low-grade ore. The Nancy Helen has been purchased by the Buffalo, and the workings of the latter have been extended to the Nancy Helen shaft. The Bailey is preparing to ship a car-load of high-grade ore. The Beaver has found good ore in the diabase formation underlying the Keewatin at the 590-ft. level. This is regarded as important in view of the fact that the veins of the Timiskaming discontinued when the diabase was reached. The company has secured the Donaldson claims, aggregating 120 acres, in the Elk Lake district, the price being \$75,000. The McKinley-Darragh made a new record for the highest value of a single shipment of ore, sending out a car-load valued at \$142,231 containing 231,270 oz. silver. The ore averaged 6000 oz. per ton. South Lorrain, Elk Lake, and Gowganda districts participate in the general revival of development and many mines and prospects which had been closed-down are being re-opened. Several 'high-graders' (ore-thieves) have been convicted and punished. Two men who stole bullion from the Nipissing, by the expedient of dipping a steel bar into the molten silver and abstracting the metal congealing round it, were sentenced to two months imprisonment, and a Finlander arrested at Niagara Falls with 40 pounds of silver bullion in his possession, for which he could not satisfactorily account, received a six months' sentence.

Porcupine.—The situation here is much less encouraging than at Cobalt and the widespread public scepticism as to the value of the mines is reflected in the apathy of the stock-market, where the tendency has been steadily downward. The four mills are all in operation, but no accurate returns of the actual production are available. This fact, coupled with the suspension of work by a large number of companies that once appeared to be doing well and to have excellent prospects, is no doubt responsible for the continued slump in Porcupine stocks. The McIntyre is extracting good ore on the 300-ft. level from a 10-ft. vein, but owing to a change in the character of the ore at depth it has been found necessary to add a cyaniding plant, which, it is stated, will raise the capacity of the mill to 100 tons per day. At the Vipond four additional plates

have been placed in the amalgamating plant, bringing the total number up to ten, which will considerably increase the percentage of recovery. A supply of good ore is obtained from the 300-ft. level of No. 3 vein. The shaft of the McEneaney is being put down to the 400-ft. level. Work on the 300-ft. level shows encouraging results, the vein, which only averaged 33 in. at 200 ft., having widened to over 6 ft. at depth and increased in metallic content. The management is preparing to erect an experimental stamp-mill capable of treating about 35 tons of ore daily. Development at the Dome Extension has been unsatisfactory. Cross-cutting at the 230-ft. level, which was expected to find large deposits, revealed a number of stringers, but they are small and broken. In other parts of the mine similar conditions have ruled, the gold content being widely distributed and the grade low. The North Dome will sink the main shaft to the 200-ft. level. The two shafts have been connected by a cross-cut at the 50-ft. level. The Standard, having failed to effect a compromise with its creditors, has gone into liquidation, and has been closed-down since June. Its assets, comprising two claims west of the Preston-East Dome, will be sold by auction. The Dome has opened up a large orebody at the 200-ft. level directly underneath the pinnacle on the surface which gave its name to the mine. It will be connected with the mill by a rise. Additional discoveries have been made at the Lucky Cross in the Swastika area, where milling ore is being extracted regularly. New finds are also reported from other prospects in this district.

A new schedule of wages was recently drawn up for the Vipond, McIntyre, Jupiter, McEneaney, and Plenaurnum mines. This involved some reductions. It was to have gone into force August 1, but the men strongly objected and appealed to the Labour Department at Ottawa. A Board of Conciliation has been appointed by the Government in the hope of effecting a pacific settlement of the dispute.

Hours of Labour Underground.—A measure was introduced in the Legislature of Ontario last session by Premier Whitney providing for an 8-hour day for miners working underground. Owing to the opposition of the mine-owners, it was withdrawn, and a resolution adopted to the effect that there should be a careful investigation of the whole subject before legislative action was taken. In pursuance of this policy, the Provincial Government has instructed Samuel Price, as mining

commissioner, to investigate the condition of underground labour. He will hold a series of meetings in the mining districts, at which all interested will have an opportunity of stating their views; he will also study the working of the 8-hour system where it is in operation, and present a report for the consideration of the Legislature.

CAMBORNE.

Levant.—This celebrated tin mine, with its miles of workings under the bed of the Atlantic, has fallen on evil times, for the manager in his latest report informed the share-

expenditure was higher by £1327 or 3s. 1d. per ton milled. It is impossible to say, however, from the account presented, whether the working costs are up or down, for in cost-book companies such as this, no capital account is kept, and consequently no depreciation ever charged; and so when extensions or renewals of plant become necessary, the whole cost is included with the ordinary working expenditure, and no indication of the amount is given. The matter over which Levant shareholders are probably most concerned just now is not the poverty of the mine, which no doubt is only temporary, but the question of the re-



NEW NIPISSING MILL TO TREAT LOW-GRADE ORE. Stripping surface by hydraulicking in foreground.

holders that not one end in the mine was in profitable ore. This must surely be an unusual experience for the manager of Levant, and it is to be hoped that an improvement will speedily take place. The account for the 16 weeks ended August 3, showed a loss of £404, as compared with a profit last time of £1083. The quantity of black tin sold was 104½ tons as against 120½ tons for the previous 4 months, but the price secured was higher by about £6 per ton, so that the difference in the amount realized on this product was only £1314. Copper sales showed an increase of £704. Altogether the drop in the receipts was £738. The explanation of the loss is to be found on the other side of the account. The coal purchased was higher by nearly £1000, almost entirely as a result of the coal strike, and merchants bills were higher by £372. The total

newal of the present lease which expires in June 1915. Negotiations have been going on for its renewal for the past 7½ years, but matters are now at a deadlock, for it is stated that the terms offered by the landowners are even worse than the existing ones. It is to be hoped that the 'lords' will assume a more reasonable attitude when they know—as a report of the meeting shows—that the shareholders are determined rather to hand over the mine to them at the termination of the present lease than to accept a new lease on the terms so far submitted. In the meantime development is to be curtailed, and no doubt the eyes of the mine will be picked out if no satisfactory arrangement is made. We can appreciate the lords insisting on a new shaft being sunk to reduce working costs, and on the adequate development of the mine, but the profits of late years,

even with the high price ruling for tin, have not been such as to justify their attempt to exact terms which would result in their getting their full pound of flesh whether the mine was profitable or not.

Grenville.—The profit of £13,794 earned at the mine for the 6 months ended June 30 last must be gratifying not only to the shareholders but to all well-wishers of Cornish mining. The dividends and bonus paid for this period amount to 2s. per 10s. share, and a sum of £2416 is carried forward. The tonnage crushed was 20,166 tons, and the produce averaged 41'02 lb. per ton, which is the highest of the larger mines of the county. The total receipts were £47,212, or 46s. 9d. per ton, and the expenditure £33,419, or 33s. 1d. per ton, so that the net profit was 13s. 9d. per ton milled. No depreciation was charged, which is surprising, seeing that much of the plant is old, and further that if the mine is to be sunk much deeper, more pumping power will be necessary. The development footage was 1 ft. for every 27 tons milled, which is not liberal by any means, but the coal strike retarded this, as the compressor had to be stopped to conserve coal. A new compressor is now being erected, so the manager has evidently not lost sight of the importance of pushing this work.

The most encouraging feature of the report is the splendid way the mine is developing in the bottom levels. The 355 west of Fortescue's shaft is now in the main shoot, which it is estimated is about 56 fm. in length, with 20 fm. of backs, through which four rises have already been put up. The 355 end east is also in profitable ground. This shaft (Fortescue's) is now 375 fm. deep, or 20 fm. below the lowest level, and drifts east and west are to be started as soon as the necessary station is cut. The virgin ground to the west of Goold's shaft is also to be explored and the bottom level (the 305 fm.) is being driven into what is believed to be a promising piece of ground.

Although the chairman's statement at the meeting of shareholders that Grenville is not a speculation but an investment was perhaps over-doing it, yet undoubtedly the policy of the present management is in the direction of making them view with equanimity a considerable drop in the price of tin.

Dolcoath.—The accounts for the six months ended June 30 show a gross profit of £32,538, which is equal to 13s. 4d. per ton milled, and is £3043 less than the previous half-year and 2s. per ton lower. After charging £2261 for income tax and £4594 for depreciation, and allowing for the 1s. 6d. per

share dividend declared, a sum of £11,736 is carried forward. The average produce was 36'73 lb., or 4'5 lb. lower than the previous six months; this drop is partly due to the fact that the better ground in the lower levels was not available for some time owing to heavy rains flooding the bottom workings earlier in the year, and partly because lower-grade ore could be profitably treated at the existing high price for tin. These floods also adversely affected the working cost, which is up 2d. per ton, in spite of the saving which must have been made through the Williams shaft being in operation.

The most favourable feature of the report is the improvement in the 490-fm. level west from a cross-cut north of the Williams shaft, which has averaged well for some considerable distance and for the last 12 fms. 100 lb. black tin per ton. It must be gratifying to the manager that his anticipations of good ore in this direction are proving correct, and will encourage him to vigorously develop this ground to the west of the shaft.

The Redruth-Chacewater district, once famous, seems to be attracting attention again, and deservedly so, for unquestionably its past history shows that it is highly mineralized. There are many setts here worthy of further exploitation, and given adequate capital, the result should be highly satisfactory. A great part of this district was opened up by the 'county adit,' which drains an area of about 30 square miles from depths varying from 40 to 80 fathoms. With this in repair, pumping charges will be materially reduced, so it is interesting to see that the company working Wheal Peevor (in which Edgar Allen & Co., of Sheffield, are largely interested) has already commenced to put part of it in repair. No doubt the expense will be rather heavy, as it has to be cleared through several abandoned mines, but the saving in the end will certainly justify the outlay on this work. At Peevor, it is the intention of the company to re-erect a 70-in. cylinder Cornish pumping engine (which is now being dismantled at the Violet Seton mine) and house it in the same building that covered the 60-in. engine, which dealt with the water in the last working.

Great Wheal Busy is another mine at which operations are shortly to be resumed. The property has been held by the Compagnie Anglo-Belge Pour L'Industrie De L'Etain for some years past. An 85-in. Cornish pumping engine, working 19-in. pitwork, was erected, and the mine drained to about 30 fm. below adit, or 85 fm. from surface, when operations

were suspended. A 10-stamp Californian battery was also erected (long before it was required, as was not unusual a few years ago), so that a good deal of the heavy work has already been done. The progress made in unwatering was not rapid owing to chokages in the shaft. It was at this mine that James Watt first introduced some of his most important improvements to the steam engine. The adjoining sett of Killifreth, of which many local people have a high opinion, is also to be started, it is said; at any rate the sett is under grant. It was about 100 fm. deep when closed-down in 1896.

East Pool & Agar.—"If they had extra capital, they would be able to realize their expectations at a much more rapid rate." These

development footage was 752 ft., which is not far short of the total footage for the year ended December 31 last, or equal to 1 foot for every 20 tons crushed. Shareholders who are concerned with the future of the mines rather than with a temporary rise in the price of the shares, will do well to encourage and urge the management committee not to slacken in this direction.

For the quarter ended June 30 last, the receipts totalled £16,662, or 21s. 9d. per ton, while the expenditure amounted to £16,533, or 21s. 7d. per ton, leaving a profit of £129, or 2d. per ton milled. The tonnage of ore milled was 15,318 tons and the recovery of tin and wolfram is given as 18'71 lb. per ton. The black tin sold was 118 tons 5 cwt. (or a



GRENVILLE MINE.

are the words of the chairman of the company at the recent meeting of shareholders, and they are in sharp contrast to the action of the management committee in recommending a dividend at the previous meeting, when the scanty funds in hand should have been wholly retained for the vigorous development of the mine and to meet the cost of the two additional air-cushion stamps that are being installed. This policy of dividing profits while neglecting the development of the mine was responsible for the collapse of many companies which should be working today, and it is satisfactory to see that the management of these important mines has turned over a new leaf and is now pressing the work of development. During the quarter ended June 30, the de-

velopment of 17'3 lb. per ton) and it fetched the high average of £125. What a necessity to East Pool & Agar is the present high price of tin!

There are several promising points being developed in the mine. At East Pool the 170-fm. level should shortly reach a junction of the Great and Engine lodes, and as junctions in these mines have usually meant an enrichment, high hopes of better-grade stuff at this point are held. The 252-fm. level on the Caunter lode has also been re-started and the lode already shows signs of improvement. At Agar, the rise from the 255-fm. level on the Great lode is going through ground several pounds higher than the present grade, and here again, the junction of the Engine and Great

lodes is the objective. On the whole, the prospects are good, now that adequate development has been started.

MELBOURNE.

Broken Hill.—The most discussed piece of news that has been made public in Australia since the amalgamation of the Zinc Corporation and the South Blocks company is the decision of the directors of the British Broken Hill to issue 50,000 new shares of £1 each. Immediately the Stock Exchange got hold of the information there was a decline in the price of shares from 60s. to 48s. This fall was incomprehensible to the ordinary shareholder. It had been known through the medium of the Stock Exchange that a deal was on the table and that this deal, if completed, would mean the fusion of the North Broken Hill, the Amalgamated Zinc (De Bavay's), and the British Broken Hill. At first, therefore, the impression of the shareholder was that this amalgamation was doomed. Then it was said that an adverse report on the British mine had been made by George Weir, the general manager of the North mine, who had recently examined the British mine in the interests of the people that were promoting the deal. Meanwhile the directors maintained a discreet silence, until a day came when they let out the news that a new issue of 50,000 shares at 50s. was contemplated, thus confirming the current gossip. Next in sequence came the publication of the information, this time not by the board, that Mr. Weir was visiting the mine; and lastly the announcement was made that the London shareholders had agreed to the issue on terms that were not submitted to the vote of shareholders in Australia. The details of this transaction are given in some detail, because they indicate a disregard of the Australian shareholder in a manner to challenge attention in the Commonwealth. That a board when deciding to raise £150,000 should not have consulted the large Australian interests was wrong. They should have delegated to the Australian board the duty of calling shareholders on this side together to state why the capital was needed and to face the music should shareholders decide that the Dead March should be played over the issue. Moreover, a much larger issue was involved than the mere raising of fresh capital, however much people on this side may feel this to be undesirable, if not unnecessary, seeing the profit that ought to have been made by the company during the recent period of high metal-prices. The point is that, should any large block of

the new shares fall into the hands of London, its control of the affairs of the British company will be immediately strengthened to the disgust of the Australian shareholder. Should the scheme for the fusion of Broken Hill interests so devoutly desired by a certain body of people be pushed, then the 'disappearance' of the British company will be much easier of accomplishment than was possible before. At the moment it is understood that Mr. Weir's visit to the British mine did not end in a favourable report to his principals. That the market should have declined indicates exactly the doubt (as to the value of the mine) arising from a series of low returns.

Company Management.—Dealing with mining generally, it may be said that it was a coincidence that while people were groping for the reason of the fall in British shares, a Mr. McGrath should stir up mud in respect to company methods. He did this in a speech on behalf of the Labour party in the Legislative Assembly, where he could air his views without any fear of the law of libel. Put bluntly, Mr. McGrath accused mining men in general of being in collusion with share-dealers with the object of attaching to themselves gains derivable from the inside knowledge that reaches them from the mines. Mr. McGrath had no difficulty in proving his case up to the hilt. Before the ink was dry on the proofs of his speech, he could have added another example to the multitude available of the way in which shareholders suffer from malpractices. At one of our big mines an effort was being made to tap a 'deep lead,' when the bore got into what looked like country-rock. The wording of the official telegram on the subject frightened a number of people who felt that the 'gutter' had still to be found. Shares lost half their value, but late in the evening a heavy and persistent buying indicated that more than covering-up of scrip was going on. By noon next day, when all the lost ground in the market had been made up, it was learnt that the bore had gone into gold-bearing 'wash.' The people who lost shares now want to learn why the buying went on during the evening of the day of the fall. The Premier has virtually promised that a Royal Commission shall investigate the matters to which Mr. McGrath has directed attention. The powerful journal *The Age*, for some reason best known to itself, has decided, while supporting the adoption of legislation to regulate company methods in the interest of shareholders, that no commission is necessary. The public demands that those who have been guilty of practices that have

made the mining industry so unpopular shall be pinned to the desk and submitted to an examination after the style of Rabelais. People do not want wealthy offenders to go about with their tongues in their cheeks, smiling at the attempts being made to shut the mining stable when all the horses have been stolen.

Queensland.—Promising developments are reported from the copper region in Northern Queensland. There the Mount Elliott mine has been winning splendid profits out of the rich ore developed from the No. 3 level down to No. 5 level. The ore-shoot on the latter level has proved to be of far greater extent than was at first hoped and therefore any doubt as to the resources of the mine has been largely removed. The company has added one property after another to its possessions, so that it must now be regarded as one of the most influential mining concerns in Australasia. This is due to the business aptitude displayed by W. H. Corbould, who deserves the highest praise for the grasp he has displayed. The Hampden company also has begun its smelting campaign. It has at least 18 months supply of splendid ore already proved and is developing a fine claim in its Trekalano lease. There are also indications that something is to be done with the Macgregor group of mines. The Mount Oxide mine, northwest of Cloncurry, has been floated, partly here and in London, and even if the terms are open to criticism it has to be remembered that the £20,000 working capital is to be devoted mainly to developing ore. This property is to be put under the management of Gerald Williams. The Mount Cuthbert has had some additional funds placed at its disposal and will sink deeper and open-up one or two of its more important leases.

Western Australia.—Nothing inspiring is to hand from this State. As the leading mines draw on their reserves more and more, so the interest in the country dwindles. At present the State affords but little attraction to the investor. This is because it is a country of great distances, it is costly travelling, and the population is small. The result is that numerous promising properties lie neglected. In Victoria 6 dwt. ore is made to pay handsome dividends. In a vast number of instances in Western Australia such a grade is below the profit margin, and so the ground lies neglected. Wages also are so high there that the working cost cannot be assured. However, with better facilities and an adjustment of wages to the necessities of the industry, a change for the better may be anticipated.

Could anything demonstrate better the attitude of labour in Australia at present than the referendum taken at Broken Hill to decide whether the agreement with the mines for a given wage to rule for a series of years shall be abrogated? Fortunately for the good name of labour wise heads among them persuaded a majority to adhere to the contract. Still the spirit to break the agreement was there and can be discussed. The mines certainly are doing well, better than perhaps at any period in their history, but so are the men. Wages run up to 15s. per shift of 8 hours. In many cases that figure is far exceeded. Conditions of life are not much more costly than in the metropolis. They would be less if blatant unionism had not taken possession of every walk of life at Broken Hill. That, however, is the workers' own look-out.

NEW YORK.

Panama Canal affairs have been much in mind the last few weeks. The great ditch is nearly completed and now that the excitement of building is nearly over, attention has become centered upon the problem of what is to be done with it. The interest has been especially keen on the Pacific Coast where each increase in transportation facilities is watched eagerly since freight costs enter so largely into the price of everything consumed. Manufacturing is as yet but little developed in California, Oregon, and Washington, and raw materials form the bulk of the exports from these states. Owing to the tariff laws, most manufactured articles come from the Eastern states and are hauled through by rail. As a result prices are high. Furniture sells for 20 to 25% more than in the East or middle West. Many things are higher. A common gas range for cooking, for example, that would cost \$16 anywhere near Chicago, sells for \$22 in San Francisco. The railroads have given low rates on Coast products Eastward, because otherwise they would not move, and have recouped by putting up the charges on return freight. While, therefore, the Western States have looked upon the Panama Canal, as has the rest of the country, as an integral part of the Nation's defences and a means for increasing foreign trade, they have been most of all concerned in the reduction of freight rates east presumably to result from establishment of frequent and direct steamship lines. This explains the fight made, largely by the Westerners, to prohibit railroad-owned steamers from using the Canal; a proposal that has provoked opposition in Canada as well as south

of the boundary, since many of the railway companies own lines of boats. The rights of the matter as regarded the proper and economic relation of land and water companies hardly enters into the discussion, because California has suffered from the action of the Pacific Mail Steamship Co., a Southern Pacific concern, which has long maintained a fleet operating by way of Panama, for the apparent purpose only of discouraging water traffic. While recently there has been a change of policy and with competition water-borne traffic has grown, the public refuses to be satisfied by professions of reform and fears monopoly by the railroads. The other controversial points relate to tolls for coastwise and foreign traffic. The first is clearly a matter of domestic policy only. None but American ships are allowed to participate in coastwise traffic and whether they pay tolls or not can hardly interest foreign shipowners, though it does have a bearing on trans-continental freight rates. In regard to foreign vessels the case is not so clear. The average American finds it difficult to understand why, having built and paid for the Canal, his country should not do with it as seems best; and since many, at least, of the foreign ships receive government subventions while American ships do not, to rebate tolls on the latter would seem a simple way to equalize matters. At first, it appeared that Congress would adopt this point of view, but there is a strong feeling also that the United States is pledged by treaty with Great Britain to the opposite course and that the word of the Government having been given, the contract must be kept.

Alaska.—The Guggenheims have become heavily interested in placers at Iditarod and a dredge is being erected on Flat creek. Keystone drills are also being used to prospect on Otter creek and it is expected that operations next year will be extensive. At Nome there has been a shortage of water and men are returning early. Quartz claims, both at Nome and Fairbanks, continue to be developed, and at the former place a 4-stamp Hendy prospecting mill has been erected by the New Era Mining Co. in Snow gulch. It is too early to say what may develop in quartz mining in the interior of Alaska.

Copper continues to dominate the Southwest. The production of the Miami company for July was over 3,000,000 lb. fine copper, the best record yet made. During the month 96,403 tons of ore was mined and 4942 ft. of drifts and rises driven. The third 8-ft. Hardinge mill was placed and the capacity of the

concentrator accordingly increased. Revised estimates of ore reserves in the copper mines of the Globe-Miami district are as follows:

Name of Mine	Tons of Ore	Percentage of Copper
Miami.....	18,000,000	2'58
Keystone.....	2,500,000	2'25
Inspiration.....	30,000,000	1'95
Live Oak.....	15,000,000	2'10
Total and average	65,500,000	2'17

Since the Inspiration and Live Oak both belong to the Inspiration Consolidated, the reserve of the latter concern may be placed at 45,000,000 tons, averaging 2% copper. The district is now producing about 60,000,000 lb. copper per year, which amount will be increased when plants under construction are completed. H. Kenyon Burch, who built the Miami mill, is now busy planning that of the Inspiration Con. and reconstructing the Old Dominion plant. The Arizona Commercial, South Live Oak, and other companies in the district are busy and many drills are at work hunting for additional ore.

Smelting practice in copper is changing as the demand for large capacity becomes strong. The Boston & Montana has just placed in operation at Great Falls a new upright converter that is 20ft. in diameter inside the shell and 17ft. high. The lining is magnesite brick $2\frac{1}{2}$ ft. thick on the tuyere side and 2ft. on the opposite. There are 62 tuyeres, $1\frac{1}{2}$ in. diam., and the consumption of air is 25,000 cu. ft. per minute. The total weight of the converter filled with metal is nearly 300 tons. The weight of the initial charge of matte is 65 tons and about 50 tons of copper will be produced from each pour. In the first run 135 tons of copper was produced from 24 hours' actual blowing-time, or at the rate of 100 tons per 24 hours elapsed time. The converter was built in the shops of the company with the exception of the castings, weighing 13 tons each, which came from the plant of the Great Falls Iron Works. The Great Falls staff, with C.W. Goodale, manager, A. E. Wheeler, superintendent, and M. W. Krecji, metallurgist, has been breaking records in more than one particular. In May, one converter, lined with magnesite brick, had made over 7,000 tons of copper without relining, and another had been in continuous operation since March 9, 1910, and had over 12,000 tons from 28'9% matte to its credit. Since about one ton of cold material has been handled per ton of matte converted, this particular converter had treated 60,000 tons of material with one lining and was still in service.



A GOLD BEARING STREAM IN ALASKA.

PERSONAL

ALEXANDER ADIASSEWICH has gone to the Californian oilfields.

H. DOUGLAS ALLEN has gone to Naraguta, Northern Nigeria.

FERGUS ALLAN, manager of the Mexico mine, at El Oro, attended the annual meeting in London.

ROBERT HAY ANDERSON has returned to Mexico City.

CHARLES A. BANKS sailed from Glasgow on August 31 for New York, on his way to British Columbia.

W. J. BARNETT is in Morocco.

THOMAS BEVAN left on August 17 for Dutch Guiana, for John Taylor & Sons.

C. E. BLACKETT, metallurgist to the Golden Horse-Shoe, has returned to Kalgoorlie.

ALEXANDER O. BROWN has been appointed manager of the Asturiana mines, Spain.

WALTER LYMAN BROWN has returned from the Gold Coast.

W. SINCLAIR BROWN, cyanide manager at Lebong Soelit, Sumatra, is spending a holiday at Glasgow.

J. M. CALDERWOOD, consulting engineer to the Messina Development Co., is here from Johannesburg.

W. A. CARLYLE is inspecting metallurgical operations at the Mazapil Copper Co.'s smelter in Mexico.

HENRY C. CARR was recently in Portugal.

PERCY E. O. CARR, general manager for the Mazapil Copper Co., has returned to the mine.

J. PARKE CHANNING is taking a motor-tour in France.

A. G. CHARLETON is leaving for Sicily about October 1, to be absent 5 weeks.

FREDERICK G. CLAPP was recently in West Virginia.

W. H. CORBOULD is due from Queensland this month.

G. ALLEN CRANE, of Merricks, Crane & Co., has returned from Peru.

A. H. CURTIS, of Hooper, Speak & Co., is examining the Suan concession in Korea.

G. A. DENNY has been elected president of the Mexican Institute of Mining and Metallurgy.

W. R. DOWLING is the new president of the Chemical, Metallurgical, and Mining Society of South Africa.

J. P. FULLER has left for Rhodesia.

W. H. GOODCHILD has gone to Rhodesia as consulting metallurgist to the Willoughby's Consolidated.

W. FRANK GRACE, having made a new

contract with the Waihi Grand Junction Gold Mining Co., has returned to New Zealand.

ANDRE P. GRIFFITHS started on August 19 for British East Africa.

L. W. C. GWYN has gone to Peru for Bainbridge, Seymour & Co.

J. A. L. HENDERSON sailed in the *Laurentic* for New Brunswick.

HYMAN HERMAN has been appointed director of the Geological Survey of Victoria.

C. A. HEUSSLER will be in Northern Nigeria for a year.

H. H. JOHNSON, of Johnson & Hoffmann, is in British Columbia.

H. EWER JONES has taken an office in Dashwood House, New Broad St.

COURTENAY DE KALB is now resident at Tucson, Arizona.

GEORGE C. KLUG has been appointed general manager in Australasia for Bewick, Moreing & Co., and W. A. MCLEOD manager in Western Australia.

ERNST LICHTENBERG has formed a partnership with ALFRED M. MACKILLIGIN, with offices at 3 Great Winchester St., London.

GEORGE MACFARLANE is again with the Wallis Syndicate in West Africa.

ROBERT MARSH, of the Braden Copper Co., is here from Chile.

E. D. McDERMOTT left on September 7 for Tanalyk, Orenburg, where he will be manager for the South Urals Mining Co.

LLEWELLYN PARKER, recently mine superintendent to the Famatina Consolidated, has been promoted to be general manager to that company in the Argentine.

G. A. RICHARD has resigned as manager of the Mount Morgan mine, Queensland.

R. J. D. RICHARDSON has returned to the Gold Coast, as manager for the West African Trust.

EDWARD A. SMITH is here from Mexico City.

RALPH STOKES sailed on September 7 for New York to act as assistant to W. W. Mein, of the Canadian Mining & Exploration Co.

U. P. SWINBURNE has been appointed Chief Inspector of Mines for the Union of South Africa.

W. F. A. THOMAE has been appointed assistant-manager for the Mazapil Copper Co., in Zacatecas, Mexico. He proceeds thither shortly.

R. B. WATSON, manager of the Nipissing mine, Cobalt, passed through London on his way to Carlsbad.

H. H. WEBB, has arrived at New York on his return from the Yukon.

THE MEXICAN OILFIELDS

By SYDNEY A. R. SKERTCHLY.

THESE immense and practically virgin oilfields, as the result of explorations made by various oil companies during the past few years, have yielded many million barrels of oil, and have produced two world's-record wells. It is a noteworthy fact that the greater part of the capital invested in the industry comes from the United States, practically the only exception being in the case of one well known English company, whose successes in the exploration of oil territory have been phenomenal. Some ten years ago, and before the advent of the British oil investor, this lack of attention to the Mexican oilfield would not have been remarkable, but today, when Russian, Roumanian, African, and South American oilfields are being exploited by British money, it is deplorable that some at least of this capital is not turned toward what is probably the most extensive and richest oil-belt known.

The best known of the Mexican oilfields is that bordering the Gulf of Mexico for hundreds of miles in a more or less north and south line running through the states of Tamaulipas, San Luis Potosi, Vera Cruz, and Tabasco, with a width of about 140 miles. This enormous region is traversed by several lines of railway, which connect the Gulf ports with the interior and the United States. Inland navigation in some of the states also affords cheap transit. In the cantons of Tuxpam and Ozoluama, in the state of Vera Cruz, several companies have successfully developed oil-lands secured by purchase or by lease. Pipelines, pumping-stations, and tanks have been constructed on a large scale, and in every case where a reasonable production has ensued from the wells the oil has found a ready market at a price that quickly marked the undertaking as a financial success.

The biggest producers as yet 'brought-in' on the Tuxpam and Ozoluama fields are the Peralta well, which yields 100,000 barrels per day; the Casiano well of 30,000 bbl. per day; and the now extinct Dos Bocas well of about 70,000 bbl., which caught fire and was lost. The first mentioned has been flowing for about eight months without any appreciable decrease in production, and its gas pressure of 825 lb. per sq. in. has also been maintained. The Casiano well has flowed under heavy gas pres-

sure for several months and shows no sign of diminution. These wells have produced enormous quantities of oil and gas, and have returned the capital invested in them many thousand times over.

The wells above described are, of course, of phenomenal production, the general run of productive wells affording from 500 to 2500 barrels per day. In the Tampico and San Luis Potosi districts there are several wells producing up to 1200 barrels daily.

As is natural to expect, when considering such a vast area of oil territory, considerable difference is noted in the oils taken from various districts. In some of them paraffin predominates over the asphalt in their base, although the reverse of this is more generally the case. A wide difference in colour and specific gravity is also notable. The colour ranges from dark sepia or black to amber, and the gravity from 10 to 30 Beaumé.

A noteworthy feature of the wells on the Tuxpam, Ozoluama, and Tampico oilfields is that those brought-in at depths exceeding 1800 ft., are, in the majority of cases, what are known as 'crevice wells,' while those brought-in at shallower depths cut into the reservoir-rock itself. The first-mentioned class embraces the most productive wells of the region. Their productiveness is apparently due to their having cut into faults or crevices that communicate with some extensive reservoir-rock at a greater depth. The crevice or fault may perhaps have existed previous to drilling, but it is more probable that such dislocations of the strata were brought about suddenly during drilling operations, when, if the boring served as a vent for gas under great pressure, the disturbance induced might be sufficient to open a crevice or fracture between the oil-rock and the well.

The flow of oil is generally accompanied by natural gases of varying pressure and composition, some of them being highly inflammable and suited for use as fuel; while others, owing to the high proportion of sulphuretted hydrogen and other noxious elements, are unfit for use as fuel and are, moreover, exceedingly dangerous to animal life.

Gases of the noxious type are generally separated from the oils, at or near the mouth of the well, in a suitable separator, from which

the gas is led through pipes and discharged at a considerable elevation, and set on fire. The light from some of the jets of burning gas is visible even in the day-time at a distance of 70 miles. In some wells drilled under my superintendence, chambers, or porous strata charged with odourless gas, have been penetrated while drilling at depths of from 1000 to 1600 ft. In some of these, the rush of gas up the well did not subside for several days; others gave out in a few hours.

The system of drilling adopted differs according to local conditions. In some districts where beds of hard sandstone and limestone are found at varying depths interstratified with marl, the cable system is used entirely. A drawback to its employment is, that when passing through the marl there is a strong tendency for the casing to stick, in which event it is necessary to put another string of casing in the well, which of course adds to the initial cost. In some instances strings of casing, which have stuck, may afterward be drawn by the use of jacks. In order to avoid the casing becoming jammed in the well, it is commonly considered good policy to move it up and down a few times every day. This allows the caved marl, which collects around the casing, to fall to the bottom of the well, whence it is raised by the bailer in the ordinary way.

When drilling in the blue and yellow marls, it is always advisable, with the cable system, to drill as dry as possible; in other words, the driller should use the least possible amount of water in his operations. Water for drilling is generally dropped down the well from the surface, by which method the whole of the ground below the casing becomes wetted. To avoid this, the water should be dumped from the bailer at the bottom of the well, the length of the 'dart' being provisionally increased if necessary. The dart is the iron rod projecting downward from the lower side of the valve at the bottom of the bailer. By adopting this method, the marl is less likely to cave and swell, the casing consequently remaining free to continue its downward course until the desired depth has been attained, at which point it may be seated on cement, or, if a drive-shoe is used, it may be driven into the rock until a good water-tight joint is formed. Each succeeding string of casing is treated in the same manner under like conditions. The casing used in wells drilled in the marl by the cable system should be of a weight exceeding that of 'standard,' and, in difficult ground, its weight should be increased to 'drive-pipe' class.

The employment of the hydraulic rotary

system of drilling is popular in districts where hard rocks are not found, or where they are of insignificant thickness. By this system, when in favourable ground, from 40 to 70 ft. may be drilled in a single shift, using the ordinary fish-tailed bit. The system is at once the most expeditious and economical known. Its chief economy is due to the fact that very long strings of casing may be put in, thus enabling a well to be finished at a minimum expenditure of casing. The deepest well in the Tuxpam district drilled by the rotary system reached a depth of 4000 ft., the whole of which, except some 200 ft. of calcareous sandstone, being in soft marl. Fish-tailed bits with a Parker rig were used throughout.

In districts where considerable thicknesses of hard rock are underlain by marl, it is usual to employ both the cable and rotary systems. The well is started by the cable-tools, and drilling is continued until the main strata of marl are penetrated, when the system is changed to the rotary method.

Difficulties likely to be met when drilling in the marl are: (1) The occurrence of large boulders; (2) excessive caving of the ground; (3) heavy gas-pressure; (4) the presence of water in quantity sufficient to arrest drilling. Any of these obstacles may generally be overcome by the intelligent driller. Extreme care is required in all such cases, however, and it is incumbent upon the superintendent or engineer under whose care the work is proceeding to exercise great vigilance at a time when obstacles such as those mentioned are encountered.

Boulders sometimes occur singly, and also in beds several feet thick, accompanied in places by a flow of water. When occurring singly and toward one side of the boring, the drilling-bit is liable to be deflected from the vertical, and either jams, or else makes a 'crooked hole.' The remedy in such cases is to fill with cement to a height a few feet above the level at which the boulders were struck. The cement is then given time to set, and drilling is resumed. Cases occur where cement may have to be used a number of times before it becomes practicable to drill past the boulder zone. The cement should, where possible, be sent down the well in the bailer and dumped at the proper place.

Excessive caving of ground is sometimes difficult to overcome. In some kinds of ground where caving is caused by absorption of the water used in drilling, the employment of the water-dumping scheme above mentioned may overcome the difficulty. In cases where cav-



THE DOS BOCAS GUSHER, AT OZOLUAMA, VERA CRUZ, MEXICO.

ing is due to the swelling of the ground either from pressure of the overlying strata or from chemical changes arising from the admission of air to the rock, or to both causes, the problem becomes more difficult, and perhaps the only remedy is to use heavy casing capable of resisting the blows necessary for driving it, taking care always to keep the casing well up to the bit, not allowing the driller to 'drill the tools out of the casing.'

Gas-pressure is another cause either of caving or of the filling of the well by sand, and if it should occur at a time when the oil-zone is reached, it may make exploitation impossible.

The presence of water either in the superficial strata or in those that lie at a considerable depth, may cause the well-driller much annoyance, or even the total loss of his work. Water struck at a depth may subside quickly and allow of cement being employed, or may have a heavy and continuous flow. Under the latter circumstances no general remedy can be applied. The details of each particular case must be studied closely and, where possible, the remedy should be applied without loss of time. Water struck near the surface is often ignored by the driller, and a wooden 'conductor' is sometimes thought quite sufficient to keep it out of the well. If such water were always confined to the vicinity of the surface, no harm to the well would result. Unfortunately, however, it has a habit of finding its way down alongside the casing, and may even finally reach the bottom of the well. Percolating surface-water may reach to a considerable depth, establishing a hydrostatic pressure amounting to some hundreds of pounds per square inch. It then often finds its way into the well through the screwed joints of the casing, or by actually reaching the very bottom of the well by following down along the side of the casing.

Under whatever circumstances water should enter an oil-well, its presence is highly prejudicial, and every known means should be brought to bear to keep it out. A heavy pressure of water created in the manner described may even completely shut-off the oil from a well that otherwise would have been very productive.

Other causes of lost wells may sometimes be traced to the use of casing that is dented; every time the drilling tools or bailer pass the dent, they rub against it until it is perforated. Cross-threaded joints in the casing, and buckling due to excessively heavy blows given when driving it, may also lead to disaster, if it be found impossible to draw such casing

and to replace the defective joint with a sound section.

Of the oil produced in the districts already mentioned, 700,000 barrels were exported during the year 1911. The amount exported during the current year will probably reach 4,000,000 bbl. crude oil. A large amount of the production is also used either as fuel in locomotives on the Mexican railways, or is sent to the local refineries and afterward distributed to consumers of kerosene, gasolene, and naphtha, for which there is an ever-increasing demand.

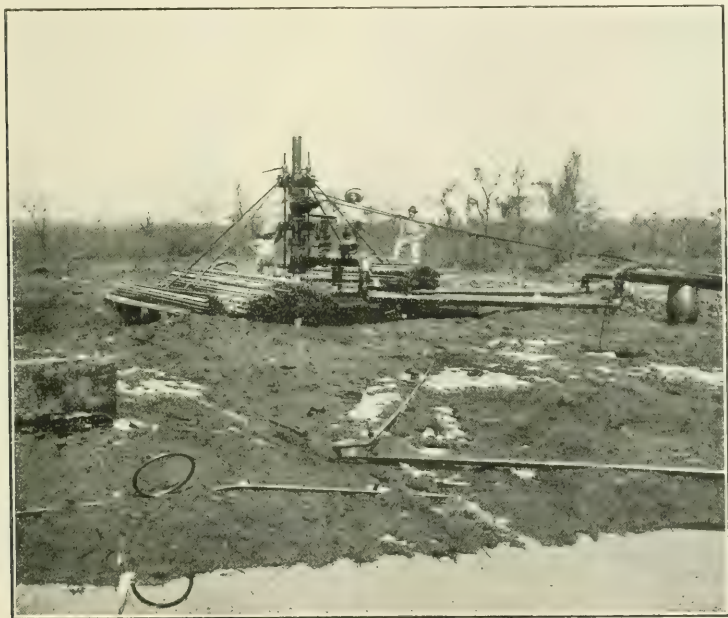
The use of crude or partly refined petroleum as a fuel where steam is generated, and also for generating power in internal-combustion engines, is coming forward rapidly, and it is undoubtedly correct to say that within the next few years oil will have made considerable strides toward displacing coal and other solid fuels in factories and steamships. Operators requiring power at mines situated in regions where solid fuel is scarce or is high priced, could undoubtedly, in many instances, effect a great economy by employing oil either as a fuel, or as a direct generator of power in some type of internal-combustion engine.

As some disappointment has been experienced by many of the English oil companies organized during the past three years, it should be pointed out that the majority of them had set themselves an impossible task from the beginning. I have heard of companies being formed to work oil leases of no more than 40 acres, the property often being described as being "near to such and such a gusher," or, "right in the centre of a productive oilfield." All this may sound promising to the layman, but when carefully studied by practical operators or engineers, the whole scheme is easily seen to be farcical in the extreme. Going into the question a little, we may ask, what would probably be the ultimate result supposing that a good well were struck on a 40-acre lease situated on one of the more or less developed Roumanian or Russian oilfields, for instance. The answer is, that within a few weeks after such a discovery, swarms of local drillers and operators would be drilling all around and within a few yards of the perimeter of the original lease, each new well contributing, of course, toward a quick exhaustion of the little 40-acre block.

Concerning explorations for oil introduced to the public, it may be said justly that no other business is cleaner in its fundamental principles, nor does any other business afford a wider scope for the opportunity to meet with

an ample recompense. We should not, however, when practising it, forget to observe and to exercise such caution as all business ventures require. By such means it is possible to eliminate many of the more doubtful factors. Companies or individuals who set themselves the task of securing valuable oil-lands may readily do so by employing for their selection only those men whose technical training and real field experience point them out as being qualified for the purpose.

scarcely needs remarking that areas of these dimensions acquired in virgin territory showing good prospects have a much greater potential value than small blocks in proved territory in a well exploited field. As it may be argued by some that small areas are frequently leased and drilled in the United States, it should not be forgotten that in the majority of such cases those who enter into such schemes are private individuals or local companies that already own other wells, pipe-lines, and tanks



THE PERALTA GUSHER AFTER IT WAS CAPPED, TUXPAM, VERA CRUZ, MEXICO.
Note pool of oil in the foreground and rails used to weight the cap.

While it is true that promising tracts of oil-land can sometimes be picked up in the more explored regions, the exception to this is the rule. Old-timers on well explored fields are too wide-awake to allow of anything of value falling into the hands of new-comers.

Referring once more to the question of the acreage of oil-leases, it may be said, broadly speaking, that the more extensive the area controlled the better. In some of the newer oil-fields, leases of a 1000 acres and more may be obtained easily on good terms, and it

in the vicinity, and who, in the event of finding anything, could, within a few hours after bringing-in their well, run a branch to their main pipe-lines at a nominal cost and have their oil on the market almost immediately.

The Mexican oilfields are calculated to produce some 25,000,000 barrels of oil during the present year. Their vast area, however, has hardly been prospected yet, and there is ample scope for securing the oil rights to areas of from 1000 acres upward under excellent conditions in promising districts.

ASPECTS OF THE MEXICAN SITUATION

By AN AMERICAN MINING ENGINEER.

NO one can forecast events in Mexico, except perhaps in the long perspective.

The size of the country, the abundance of its resources, and the immense investments of foreign capital, constitute a guarantee that an indefinite continuance of internecine warfare will not be tolerated. The length of time allowed to pass by the government at Washington without calling Mexico to account is amazing, and the acquiescence of other powers in the *laissez faire* policy of the Taft administration is almost incomprehensible. Many Americans feel that their country is, for the time, disgraced through the disregard of their rights to conduct business beyond their borders, and of their rights to immunity from personal assault and violence, because the incumbent of the presidential chair, in his ambition to be re-elected, fears lest he may arouse the hostility of a large class of smug Eastern voters to whom the concept of Mexico is no more vivid than that of Assuan.

An invasion of Mexico would be deplorable, without proper guarantees against annexation. Some months ago the mere threat of intervention would have strengthened the hands of Madero's government, and would have dealt a blow to Orozco through cutting off resources of money and munitions of war, that would have brought the revolution to a speedier end. The psychological moment for such a solution having passed, any cause sufficient to provoke invasion might lead to grave consequences. The West is keen for intervention. Familiar with lands similar in climate and resources to those of Mexico, the Westerner realizes the opportunities for commercial development existing in the Transbravine* republic if it should fall under American control.

Since outrages of the most flagrant character would now be required to compel President Taft to ask for a congressional resolution endorsing resort to arms, the temper of the people would not then sanction guarantees of Mexican autonomy, and it might be difficult to hush the cry of "On to Panamá!"

By playing at *cunctator*, Mr. Taft has reached a point where the Mexican problem becomes an international dilemma. The for-

eign power that should attempt to force America to perform police-duty in Mexico might provoke acts that it would probably view with concern. On the other hand, the power that should attempt to perform that police-duty in which America has failed would meet with a resistance the strength of which may be measured by the enthusiasm over Senator Lodge's resolution, passed the other day by the Senate, warning the world of American disfavor at any attempt by foreign nations to secure further military bases in the western hemisphere. Although that resolution was aimed primarily at Japan, it is taken in a more widely inclusive sense by the multitude.

These larger phases of the Mexican revolution dwarf the importance of the details of the civil struggle itself. The spread of Orozco's movement can never become great, because the commercial interests of the country, from the vendor of groceries in remote rural *pueblos* to the merchant in the distributing centres, are out of sympathy with political disorder. The wholesale merchants are carrying arrears of out-of-town customers that are so heavy as to bring many of them to the verge of financial ruin. Credit has been withheld until the shelves of the small traders are nearly depleted. In like manner the lesser merchants have more closely drawn the line of credits, and the sentiment for peace is the expression of the people's purse. Against this lies the fact that the elective franchise, granted in theory to the *hoi polloi*, has puffed up with arrogance a horde that is inexpert in self-government and is the easy victim of ambitious politicians who regard revolution as lightly as a week-end shoot. Thus the establishment of permanent quiet seems remote, and various leaders, dominating certain districts after the manner of Spanish *caciques*, will keep marauding bands in motion for a considerable period.

Orozco has discovered that the general sentiment calling for a new régime, which rendered Madero's revolution popular and successful despite the military weakness of his organization, did not exist for him, and he was forced to appeal to the spirit of loot and rapine to win adherents. Notwithstanding this and the growing unpopularity of the Madero ad-

*Our learned correspondent uses an unfamiliar term. Bravo del Norte is the former name of the Rio Grande, which for several hundred miles serves as a natural boundary between Mexico and the United States.—EDIT.

ministration, he has failed. Had he better understood the strategy of attack he might have scored a victory in the advance upon Torreón. His generalship did not rise to that pitch, but he has proved himself a master in conducting an orderly retreat. His revolution has not degenerated into guerrilla warfare, nor has his retreating army disintegrated. The latter result, however, must be in large part ascribed to the policy of the central govern-

guarantee the universal enjoyment of civil rights by the home population equally with the alien.

The friction existing between the United States and Mexico requires diplomatic attention, and financiers abroad must determine acts and policies leading to the restoration of a strong government in exchange for the funds necessary to achieve that end. It is properly conditioned financial assistance that Mexico



STREET SCENE IN MEXICO.

ment in withdrawing the guarantees of amnesty. This mistaken edict tended to consolidate the rebel forces after their retreat to the cover of the Sierra Madre.

The solution of the Mexican problem is one for statesmen, and it remains to be seen whether the November elections in the United States shall promise the attraction of that kind of talent to Washington. At the present time an intense anti-foreign feeling is rife in Mexico. This can be overcome only by absolute abandonment of the monopolistic policy of industrial expansion through concessions, and the strengthening of the central government so as to insure such thorough policing of the country as to protect the lives of foreigners, and to

now needs, and a reorganized and increased army and corps of *rurales*.

The Oil-driven ocean-going ship *Selandia*, particulars of which we gave in a recent issue, is reported to have consumed less than one-third the weight of fuel as compared with a ship burning coal, during her first voyage from Europe to the East. The average consumption of oil per day was 9 tons at the speed of $10\frac{1}{2}$ knots. The ship is 370 ft. long, with a registered tonnage of 4964, and a cargo capacity of 7400 tons. The engines are of 2500 hp. During the voyage, all varieties of weather were encountered, but the consumption of oil and the speed were fairly constant.

METAL MARKETS

COPPER.

Average prices of cash standard copper :

August 1912	July 1912	August 1911
£78. 17s. 1d.	£76. 13s. 10d.	£56. 7s. 6d.

Prices have fluctuated during August between £77 and £80 for standard copper without any sustained movement in either direction. The industrial situation is still entirely favourable, and the American harvest is assured as equal to the most optimistic anticipations. On the other hand the increase in stocks and the rise in money rates has induced speculative selling, both by bull operators realizing and by fresh bear commitments. Consumers have been conspicuously quiet for the greater part of the month, and this may be attributed to the influence of the holiday season; but they must be poorly supplied. In France and Germany some important orders were given out toward the end of the month, and in America the producers report substantial sales. The price of $17\frac{3}{4}$ cents for electrolytic has not been reduced by American refiners, who appear to be well sold to November. In the sulphate trade inquiries for supplies for the coming season both in England and in Italy are coming forward, and another good year is anticipated. The increased production shown in the refiners' figures is welcomed, as removing fears of short supplies and a runaway market. With the prospects all in favour of a heavy consumption, manufacturers can with confidence take fresh orders without the risk of being unable to obtain their raw material except at ruinous prices.

TIN.

Average price of cash standard tin :

August 1912	July 1912	August 1911
£208. 3s. 0d.	£202. 8s. 3d.	£190. 9s. 7d.

Following the Banca sale at £210. 7s. 6d. and with favourable statistics, prices dropped to £202. 15s. cash and £200. 5s., three months under bear attacks, but quickly recovered on good consumptive buying, and eventually displayed considerable strength. America as usual has been the most pressing purchaser, and good orders for the Welsh tinplate works and the continent for early delivery have also been received. Prices consequently have risen persistently, closing for the month at the top, namely, £218. 5s. cash and £217. 5s. three months. Consumers everywhere are very busy and seem poorly supplied. Large business has been done from the Straits where

Chinese dealers have been ready to take advantage of the rise. Consumption seems to be still going ahead and outstripping the supply.

SPELTER.

Average prices of ordinary brands :

August 1912	July 1912	August 1911
£26. 1s. 2d.	£25. 13s. 1d.	£26. 11s. 2d.

The market, after being dull for a long time, shows a revival, and the syndicate appears to contemplate an advance in price. The American galvanizing business is expanding, and exports to that country are contemplated.

LEAD.

Average prices of soft foreign lead :

August 1912	July 1912	August 1911
£19. 5s. 8d.	£18. 8s. 9d.	£14. 1s. 4d.

The rise in the price of lead has been most marked. Supplies are almost entirely absent, and the metal commands famine prices. Misled by dealers with bearish views, and ignoring the enormous continental consumption and the decreased output both of Spain and Mexico, London consumers have allowed themselves to run short. They have therefore been forced into a market bare of supplies, and are paying for their shortsightedness in the premium which such a situation naturally produces. The syndicate is now sold out for October, but as London, the only free market, is badly bought for the next two months, developments are bound to be interesting.

SILVER.

During August the price of silver had a sudden rise and at one time the quotation was as high as 29½d. per ounce. The cause of this movement was a temporary shortness of supply in speculative circles.

OTHER METALS AND MINERALS.

Prices quoted on September 10 :

SILVER.—28½d. per oz.

PLATINUM.—185s. per oz.

BISMUTH.—7s. 6d. per lb.

ALUMINIUM.—£76 to £79 per ton.

NICKEL.—£170 per ton.

ANTIMONY.—£27 to £28 per ton.

QUICKSILVER.—£8. 5d. per flask.

MANGANESE ORE.—9d. to 1s. per unit (1%).

IRON ORE.—Cumberland hematite 26s. per ton at mine. Spanish 22s. 3d. delivered in England.

FIG IRON.—Cleveland 65s. per ton. Hematite 78s. per ton.

WOLFRAM ORE.—28s. per unit (1%).

THE COROCORO DISTRICT, BOLIVIA

By LESTER W. STRAUSS

THE first development of this copper zone probably goes back to the early civilized Indians, who ruled the highlands of Bolivia and Peru before the later races that were conquered by the Spaniards.

Corocoro lies in a ravine cut out of the eroded sandstone forming the highland plateau that was apparently once part of the Lake Titicaca basin. The topography of the region is an open country with low rolling hills. Telegraphic communication with the outside world is obtained through La Paz and Tacna (Chile), the latter town being in touch with the cable service abroad. All food-stuffs are brought from the outside, including fish from Lake Titicaca and the Desaguadero river. Drinking water is piped into the town and is of good quality, but limited. The climate is healthy, the fevers that ravage the Indians being due to their utter lack of cleanliness. The air is quite warm during the day from May to November, which is the dry season; but it is generally cool at night and often windy. The wet season—December to April—is rendered disagreeable by rain and snow. The altitude of the town is 4000 metres (13,120 feet) above sea-level; the population, of which few are white, is about 5000.

Corocoro is situated in the province of Pacajes, in the department of La Paz, and about 100 kilometres southwest of the nominal capital of Bolivia, La Paz. At present it is accessible by three routes from the coast, namely, from Mollendo, in Peru, and from Arica and Antofagasta, in Chile. The Arica-La Paz line, recently completed, passes within 5 km. of the town at kilometre 344, which is the station of Two Chimneys. A branch railroad is likely to be built to replace the present wagon communication. An interesting feature of the Arica-La Paz line is the 40 km. of rack-road opera-

ting on a maximum grade of 6%; the gauge of the track is 1 metre. It will be possible to make the trip from Arica to La Paz—446 km.—in 18 hours up and in 14 hours down. The line passes close to the famous Tacora sulphur deposit. The Chilean government will have



BOLIVIA, SHOWING POSITION OF COROCORO.

control of the operation of this railway for the first 10 years, after which time the Bolivian section (230 km.) will be taken over by that government. The road has been built for strategical purposes and gives Bolivia the shortest haul to the coast. By way of Mollendo the route permits a visit to Arequipa, the second largest city in Peru and of historic interest, as well as involving a 12-hour steam-

boat journey (195 km., from Puno, in Peru, to Guaqui, in Bolivia) across Lake Titicaca, the highest steam-navigated body of fresh water in the world, no less than 3822 metres or 12,536 ft. above sea-level. Puno is 523 km. by rail (standard gauge) from Mollendo, over the Southern Railroad of Peru. From Guaqui to Viacha is 65 km. by rail (of 1 metre gauge) over the Guaqui-La Paz railway. La Paz is 31 km. farther east and is the terminus of the road. From Viacha to Two Chimneys, over the Arica-La Paz line, is 70 km. south-westerly; the total distance from Mollendo is 853 km. and might require 34 hours on the up trip and 32 hours on the down trip if the express is caught at Viacha. Up to the present time the concentrate, or *barrilla*, has been sent by llamas, donkeys, or carts from Corocoro to Nazacara, on the Desaguadero river, 45 km. north-westerly, and there loaded on the river steamers, which draw $1\frac{1}{2}$ feet of water and have a carrying capacity of 100 tons. This small draught is due to the shallow water, and the presence of sand-bars in the river, which is the outlet of Lake Titicaca. From Nazacara to Guaqui is 65 km., and re-transfer is made to the lake steamers at the latter point, and again at Puno to freight-cars. At Mollendo the concentrate is loaded into lighters and sent alongside the steamers. The total freight-haul is 783 kilometres. The numerous handlings are stated to result in a loss of 1 to 2% of concentrate. The haul to Arica should obviate this loss and prove cheaper, but the management of the Southern Railroad is likely to remedy defects and offer reductions so as to retain a hold on the in-going and out-going freight. The charge on concentrate from Corocoro to Nazacara is 45 centavos (8'6 pence) per Spanish quintal (101'44 lb.), and from Nazacara to aboard-ship at Mollendo the tariff on concentrate is £2. 4s. 6d. per metric ton. The Antofagasta line, also 1 metre gauge in Bolivia, is 1125 km. long from the coast to Viacha, the total length to Two Chimneys being 1195 kilometres. The journey from the port of Antofagasta takes one first through a portion of the nitrate region, then the copper districts of Chuquicamata and Conchi, the borax fields, and across the southern end of the great Titicaca basin toward the main range of the Andes, skirting the western portion of the silver and tin districts that extend from Uyuni to Oruro. To Viacha it is 201 km. farther. The weekly express takes 44 hours for the up-trip to Viacha and 42 hours for the down-trip. From Viacha to Two Chimneys will be less than a 3-hours ride.

The mining laws of Bolivia leave much to be desired, but the defects have been realized and, it is expected, will soon be remedied. Their tone is liberal, foreigners sharing equal rights with the natives. The priority of location (or 'denouncement') and compliance as to taking possession, as well as the yearly payment of 4 bolivianos (6s. 4'8d.) per hectare (2'47 acres) are the essential features. In Corocoro the older laws fixed boundaries so as to meet the vagaries of the mineralized strata, and this resulted later in litigation. At present, all such questions have been definitely settled.

The economic mineral is native copper, with which are associated other minerals, such as malachite, chrysocolla, azurite, domeykite, and chalcocite, occurring in various beds or strata of sandstone and fine conglomerate. Silver minerals are rare, gypsum and salt being the principal gangue other than the quartz.

Locally the terms *vetas* or 'veins' and *ramos* or 'branches' have been applied to the strata dipping southwest and northeast, respectively, the strike being N 30° W and S 30° E. The former is conglomeratic and contains copper in coarse particles, while in the latter the quartz grains are finer and the copper also is fine grained and in masses. The outcrops of the *vetas* are traceable, continuously, for over 5 kilometres; there are no *ramo* outcrops. The contact of these two beds is well defined on the surface and more so in the underground workings, probably representing a line of weakness or fault-plane. The width of the mineralized layers, of which six of each kind have been exploited, varies from a few centimetres up to 7 metres (23 feet), the ore forming shoots. Sheets and masses of copper—locally called *charqui*—occur up to 600 pounds in weight, but the copper is found generally in minute grains, pellets, or granular masses. The mineralization appears to be due to the reduction effected by organic matter, as well as the replacement of the cementing lime that filled the interstitial spaces in the sandstone.

From the data available the total production from 1873 to 1912 is estimated to have been nearly 200,000,000 lb. copper. The present yearly output is 5,000,000 pounds. Local smelting of the concentrate was attempted in reverberatory furnaces but apparently without success. Previous to 1909 the various properties were operated individually; now there are but two active companies, the Compañía Corocoro de Bolivia, a Chilean company formed in 1873, and the Corocoro United Copper Mines,



*LOOKING NORTH ALONG THE OF TROP, VETAS DIPPING TO THE LEFT AND RAMOS TO THE RIGHT.
Road from Teco Chonens in the centre.*



SAN FRANCISCO MILL, with the Capilla mine in the background.

Ltd., the recent consolidation of several properties controlled by French capital. The latter company is working the Guallitiri, Santa Rosa, and Vizcachani mines, with their respective mills; the former operates the Remedios, Capilla, and San Agustín mines, and the San Francisco mill. The Remedios shaft is the deepest, the 15th or bottom level being 422.5 metres (1386 feet) deep; the Chalcoma shaft on the Guallitiri claim is 385 m., the Santa Rosa 300 m., and the Vizcachani 287 m. deep, respectively. All the shafts, of which there are nine equipped for hoisting, are vertical and either of rectangular or circular cross-section. The Chalcoma, Remedios, Santa Rosa, Capilla, and San Agustín are rectangular, with two hoisting compartments but no manways. The Vizcachani is a circular single-compartment shaft. Entries to the mines from the surface exist through old workings.

Prior to the consolidation of the various properties into the Corocoro United Copper Mines no systematic exploration or exploitation was attempted. The shafts, with three exceptions, have been sunk on the *veta* formation, as this was the first opened up. With increasing depth, the *vetas* began to diminish in mineralization, and the *ramos* being exploited, it became necessary to explore through cross-cuts. The Remedios shaft fortunately was sunk so as to require a minimum amount of cross-cutting; on the 15th level it is within a few metres of the *ramos*, which here are almost vertical. The *vetas* do not appear to carry mineralization to this depth. The 10th or bottom level of the Vizcachani shaft is about 35 m. from the *ramos*, and the dip of the beds indicates further driving necessary with increasing depth. Again the *vetas* do not appear to be mineralized to this depth. The method of opening up the levels—usually from 20 to 30 m. apart—is to drive a cross-cut from the shaft to within a few metres of, and drive parallel to, the strike of the *ramos*, making cross-cuts every 10 or 15 m. through the mineralized bed. Overhand stoping is then begun, two methods being used. The Compañía Corocoro de Bolivia employs rises, either vertical or inclined, to enter the stopes and for handling the ore, while the Corocoro United uses only vertical rises for the ore, access to the stopes being obtained over the broken waste from either side of the cross-cuts. The rises, circular in cross-section, are carried up as stoping proceeds and are lined with stone cut and shaped on the surface. Where the cross-cuts are in soft ground, and in the drifts, a system of pack-walling is used,

(locally called *poteo*), the stones for this purpose being shaped on the surface. The men employed in such work, known as *pongos*, average 5 to 6 metres per pair in 12 days of 10 hours each. Timbering has proved too expensive; steel sets also have been tried in some places.

In stoping, holes are drilled about 18 inches deep, by single-hand work, and blasted with black powder, of American make, about $\frac{1}{4}$ lb. per hole, thus making the minimum amount of fine as compared with dynamite. At one time black powder was made locally, using the sulphur from Tacora and the nitrate from Chile, but, although cheaper, it proved inefficient. The broken ore is roughly sorted, the fine being lost in the waste, and dropped through the rises to the level-floor and then either shovelled into cars or packed in *capachos* (a native bag made of cowhide) on boys', girls', or women's backs, to the shaft. Here the ore is dumped on the floor and shovelled into skips of either one or two ton capacity. On or near the surface, the skips empty either into bins or cars. At the Remedios shaft the bins discharge into cars, of 1.2 tons capacity, which are trammed by gravity through a 600 m. adit to the weighing-scales, whence mules take the ore to the San Francisco mill. At the Corocoro United mines sorting is done on the surface before the ore is milled. The Vizcachani and Santa Rosa ore is sent to their respective mills, from the sorting-sheds, by aerial trams about 3500 m. and 2000 m. long respectively; these are of the Bleichert system and require a little power to keep them in motion, owing to the low gradient. At the Guallitiri mine the ore is trammed by gravity for 600 m. from the interior shaft to the mill; the Chalcoma shaft is used for exploration work until the proposed mill is erected.

The mines are comparatively dry, the inflow being easily handled by bailers; no pumps are in use. The water is decidedly saline as well as acid; it is not serviceable for milling and as little as possible is used in the boilers. From the Remedios mine about 2500 gal. is hoisted per day, through an old shaft used specially for that purpose, which was four times the amount handled during the previous year (1910).

It is of interest to note that owing to the scarcity of men and boys, a considerable percentage of women and girls are employed underground to handle the broken ore. The natives have been using mutton-fat for lighting, but kerosene, which is cheaper, is now employed.

The Santa Rosa and Vizcachani shafts are being replaced by a new shaft modernly equipped, particularly as regards sorting arrangements at the surface. The head-frame will be steel. Electric drills, with auger-bits, are being tried with a view to expediting development work.

No systematic sampling is attempted, the mill returns furnishing an idea of the copper content, as recovered, of the sorted run-of-mine ore.

Water for milling purposes is scarce and brought some distance. It is used altogether four times, in as many mills, before running

double stones and cast-iron rims. The discharge passes over a shaking screen (operated by a native who scrapes the screen while imparting motion with his foot) with $1\frac{1}{2}$ or 2 mm. holes. The over-size is sheet or nugget copper; the under-size passes to classifiers either by gravity or elevators. In the San Francisco mill, where no shaking screens are used, the discharge from the wheel-elevator passes to a conical trommel, with 2 mm. openings, the fine going to a four-compartment classifier (recently replaced by a Richards classifier), and the coarse is returned to the single-stone Chilean mill. From the classifiers the coarse



GUALLITIRI CHICA MILL, WITH TRAMWAY TERMINAL. *Note desolation of landscape.*

to waste. There are five concentrators in the district, four being in operation, namely, the San Francisco, Guachuni, Guallitiri Chica, and Guallitiri Grande. The first mentioned treats ore principally from the Remedios mine, the second receives ore from the Vizcachani mine, the third from the Santa Rosa mine, and the fourth from the Guallitiri mine, the three being operated independently of each other and using the waste-water from the San Francisco mill, in the order named, after the previous mill has discharged it. About 8 tons of water is used per ton of ore. The method of treatment in the four mills is similar, differing only in slight details. The milling capacity of the plants varies from 90 to 130 tons of ore per 24 hours. The coarser ore, over $1\frac{1}{2}$ in. size, is reduced by jaw-crushers before going to Chilean mills, which have either single or

goes to jigs and the fine to tables. In the three mills of the Corocoro United the fine goes to settling-boxes, the coarse discharge from which passes to Wilfley tables (the middling of which is fed to Ferraris tables), and the fine to settling-ponds, the clear water being pumped back for re-use in the mill. In the San Francisco mill no settling-box is used, the fine going direct to Ferraris tables, the middling of which is washed by hand in wooden trough-like boxes with concave bottoms. The concentrate is re-washed on a Ferraris table, whereas in the other mills this cleaning is done by hand in the wooden boxes just noted. The coarse from the classifiers is fed to jigs, usually of the Hartz type, the middling of which is transferred, by hand, to the jigs, while the tailing discharge goes to Chilean mills. Washing-jigs are used for the concentrate, the water

from them going to settling-ponds, or the washing is done by hand in the wooden boxes, or by grinding the concentrate and stirring it in a barrel and decanting the suspended quartz grains. The concentrate—locally called *barrilla*—is dried on iron plates or in a revolving furnace in the wet season, and by the sun in a large patio (being stirred by bare-footed children) in the dry season. The concentrate is packed in bags holding 23 kg. (50·7 lb.) net weight, two bags forming a load for a llama.

Systematic mill-sampling is not attempted, although the extractions are stated at 90%, which is higher than is accomplished. The concentrate varies from 75 to 88% copper, with not sufficient silver to be paid for. The surface minerals have been reported to carry silver and a little gold, but in the deeper workings their presence is not indicated by assaying. The copper content of the ore milled, based on the concentrate recovered, varies up to 3·5%. The tailing ranges from 0·7 to 2% copper. It is of interest to note that the tailing is re-washed profitably by women, yielding a concentrate of 60% copper. The washing is done in the trough-boxes already mentioned. They select probable enriched spots in the tail-race when digging into the accumulated tailing.

The native lessees—or *quintaleros*—treat the sorted ore from the San Agustin mine by *quimbaletes*, a crude and slow system by which about one ton can be crushed per shift; from 10 to 15 quintals of concentrate are made in 15 days on first-class ore. The concentrate produced is hand-washed and averages about 70% copper as shipped. The process involves crushing in water, the rocking motion given to the *quimbaleta* serving to concentrate the copper.

Up to the present time the oxidized ores have not been utilized, but they may be shipped now that the Arica-La Paz railroad is in operation, for the copper content is stated to vary from 15 to 30 per cent.

The mills and hoisting plants are driven by steam-power. The Lancashire boiler is the common type, being fired with *taquia*, or llama dung, and to lesser degree with peat or *yareta*, a native fungus growth.* The calorific power of *taquia* is given at 1200 calories; about 6 tons are equal to 1 ton of coal. About 15,000 tons of *taquia* are consumed yearly, the transport being an extensive industry, and the taxation an important source of income to the municipality, as five centavos are collected for each

quintal brought into the Corocoro. This tax is usually put up for auction at the close of the year, and is bought at a minimum figure by one of the companies, the other sharing the outlay proportionally. At times there is keen competition for the purchase of *taquia* and high prices are paid, as a scarcity of it seriously affects continuous operations in the mills. Each company has special men who arrange contracts for this fuel. The cost, including the tax, varies from 0·68 to 0·70 bolivianos (13·1 to 13·4d.) per quintal of 101·44 lb.; it is of poor quality, being mixed with soil when collected, and makes much slag, whereas when clean little ash is made. Experiments with *taquia* in a gas-producing plant indicate a cost of 4 centavos (0·8d.) per horse-power-hour, as against 23 centavos (4·4d.) per horse-power-hour when used under the boilers. Coal costs 100 B. (£8) per long ton.

The nearest water available for hydro-electric power is the Mauri river, 40 km. distant. Electric transmission from La Paz has been suggested (the distance would probably be less than 90 km.) at a cost of 8 centavos (1·5d.) per horse-power-hour. Such an installation would reduce costs, as well as permitting more continuous operations of the mills. At one plant 45% of the milling cost is for *taquia*, this figure being about 15% of the total operating cost.

Some idea of the cost of materials, placed in Corocoro, is obtained from the following:

	Bolivianos	English
Black powder (American), per pound.....	0 32	6 1d.
Dynamite, 60%, per pound.....	0 85	16 3d.
Drill steel, ordinary, per pound..	0 29	5 6d.
Charcoal, per 100 lb.....	3 00	4s. 9 6d.
Coal, per 2240 lb.....	100 00	£8.
Kerosene, 5 gal.....	5 30	8s. 5 8d.
Timber 8 by 8 in. per board-foot	0 32	6 1d.
Timber (round) 8 in. diam. ..	0 20	3 8d.
Stones for pack-wall, per 100....	7 50	12s.

Copper concentrate is subject to an export duty of 56 centavos per quintal, 101·44 lb. (17s. 8·9d. per ton), without regard to the copper content. The through-freight charge from Corocoro to aboard-ship Mollendo is 1·95 B. per quintal of concentrate (£3. 1s. 6d. per ton).

It has been aptly stated "that the natives believe that their god created day for rest and night for sleep." The native or Aymaras, male and female, is a fairly efficient labourer, but the craze for alcohol, and more particularly the numerous feast-days, seriously affect operations. In Corocoro about 100 feast-days, inclusive of Sundays (although an attempt has been made to work on alternate Sundays), are

* *Yareta* is not a fungus but an umbelliferous plant, the *azorella glebosa* L. f. 11109

celebrated per annum, and considering the condition of the labour after such *fiestas* the time lost is a serious handicap. The Indians are hardy and can endure long hours; in one mill a 36-hour shift is frequently a necessity. Their principal food is *chunga* or frozen potato, *chalonga* or dried mutton, and *coca*, the last having sustaining qualities by reason of its cocaine content. Wages are as follows:

	In bolivianos per shift	In pence per shift
Miners	1 80 to 2 00	34'5 to 38 4
Trammers.....	1'30 „ 1'60	25 „ 30'7
Pack-wall men.....	2 00 „ 2 20	38 4 „ 72 2

Contracts for underground work are made whenever possible. Driving is done for 4 to 12 B. (6s. 4'8d. to 19s. 2'4d.) and cross-cutting for 6 to 15 B. (9s. 7'2d. to £1. 4s.) per metre. The opening drift is usually 1 by 1'75 metres; the prices given include powder but not tramming, the company supplying the steel. In sinking a shaft of 2 by 3'80 m., the price, including timbering, powder, steel, supplies, and hoisting, is about 150 B. (£12) per metre. Pack-walling, including stones and labour, is done for 25 B. (£2) per running metre.

Contracts for treating ore with *quimbaletes*



LLAMAS LOADED WITH CONCENTRATE, READY FOR JOURNEY TO NAZARE. Aerial tram in background.

Skip-loaders.....	1'20 „ 1'30	23 „ 25
Women, girls, and boys...	0'90 „ 1'00	17'3 „ 19'2
Surface trammers.....	1'80 „ 2'00	34'5 „ 38'4
Mule-boys.....	0'50	9'6
Time-keepers and scalemen	2 00	34 0
Mechanics, carpenters, & blacksmith.....	up to 5'00	96
The hours are from 7 a.m. to 5.30 p.m.		
Mill-hands are on the 12-hour basis		
Chilean-mill tenders.....	1'20 to 1'35	23 to 24 09
Crusher-boys.....	1'25	24
Trommel and classifier-tenders	1'10	21'1
Jig-men	1 50 „ 1 80	28 9 „ 34 5
Table-men	0'90 „ 1'50	17 3 „ 28 8
Tailing-laundry cleaners.....	1'20	23
Women washing middling.....	0'70 „ 0'65	11'5 „ 12'5
Women drying concentrate, etc.....	0'40 „ 0'60	7 7 „ 11'5
Women washing river tailing, per quintal of concentrate.....	4'00	72 „ 56

vary from 2'60 B. (4s. 2d.) for sorting and crushing high-grade ore (from which 10 to 15 quintals of concentrate can be recovered in 15 days) to 7 B. (11s. 2d.) per quintal of *barrilla*, the lower price being for low-grade ore from which 1 to 1½ quintals can be recovered in 15 days.

Cost data for two mines, operating under practically the same conditions, are given, but it is to be noted that the distribution, per quintal of *barrilla*, is widely different. The cost per ton or pound of copper affords the only basis of comparison.

MINE NO. 1.—Production 10,000 quintals of *barrilla* (380'40 tons copper) averaging 75% copper, in three months. Data as to the ore milled representing this output are not available, but it was probably 12,000 tons.

	Bolivianos	English
Mining	8'00	12s. 9 6d
Extraction (hoisting).....	2'05	3s. 3'4d
Sorting on dump and aerial tram		
to mill.....	0 80	1s. 3 4d
Milling.....	3 75	6s.
New work	0 80	1s. 3 4d
General expenses	2 55	4s. 1 0d
Amortization.....	1'25	2s.
Incidental expenses.....	1'50	2s. 4 8d.
Export duty	0 56	10 8d.
Freight to aboard-ship Mollendo.....	1'95	3s. 1'4d.

Total aboard-ship Mollendo per quintal.....23 21 £1 17s. 1 8d

This is equal to £55. 9s. 5d. per ton of copper (2240 lb.) or 12 cents U.S. per pound of copper, to which must be added freight to Europe and selling commissions.

MINE NO. 2.—On a basis of 28,560 tons of ore milled yielding 19,236 quintals of *barrilla* averaging 82'56% copper (804'6 tons of copper) or copper content per ton of ore milled, as recovered, of 2'82% (56'4 lb.). One ton of *barrilla* represents the concentrate from 29'3 tons of ore.

	Bolivianos	English
Mining	4 90	7s. 10 1d
Extraction (hoisting)	4 19	6s. 8 4d
Milling	7 79	12s. 5 6d.
Administration	1 44	2s. 3 6d.
Export duty	0 56	10 8d.
Freight to aboard-ship Mollendo	1'95	3s. 1'4d.

Total aboard-ship Mollendo per quintal.....20 83 £1. 13s. 3'9d
Freight to Europe 1 55 | 2s. 5 7d || Commissions..... | 1 81 | 2s. 10 8d. |

Total cost in Europe per quintal.....24 19 £1. 18s. 8'4d.

The apparent cost of the copper placed in Europe is £52. 11s. 2'5d. per ton or 11'38 cents U.S. per pound of copper. The total cost per ton of ore milled is 16'55 bolivianos (£1. 6s. 5'8d.).

The annual report of the Corocoro United Copper Mines, for the year ended June 30, 1911, stated that 67,000 tons of ore mined was hand-dressed to 47,481 tons of ore, averaging 3'32% (66'4 lb.) copper, as recovered, which yielded 2038 tons of concentrate (40,179 quintals) of 77'38% copper content (1577 tons of copper) at a cost of £47. 12s. 3d. per ton (2240'0 lb.) of copper, which is equivalent to 10'3 cents U.S. per pound of copper or 20'60 B. per quintal of *barrilla* equal to £1. 12s. 11'5d. per ton of ore milled. The above figures indicate that 29'1% of the ore hoisted was rejected by sorting at surface, and in milling 23'3 tons of ore yielded one ton of *barrilla*.

Mining and milling	4 7 13 0	per ton (2240 lb.) copper
Export duty	1 6 9	" "
Transport to the coast	4 12 6	" "
Freight to Europe.....	2 2 0	" "
Selling commission	1 18 0	" "
	47 12	" "

When its modern improvements are completed, and they are now nearing completion, the company may be able to place its copper in Europe for about £41. 11s. per ton or 9 cents U.S. per pound.

Individual months, in one mine, have been recorded with costs (the copper placed in Europe) as low as £37 per ton of copper or 8 cents U.S. per pound, where the copper content was above the average and the mill operated continuously.

The *barrilla* contains no silver or gold that is paid for by the smelter. The entire product of the district is shipped to France, where better terms are obtained than elsewhere; the full copper content is paid for at the quotation of standard copper, on the day of sale, with no smelting or refining deductions. The *barrilla* is assayed, at Corocoro, by the dry (or fire) method on 10 grammes charges run in duplicate; the smelter returns are based on electrolytic determinations. Shipments take from 2'5 to 5 months to arrive in Europe.

Bolivian exchange is variable, although the Government has attempted to fix it at 12'50 bolivianos to one pound sterling; with exchange at \$4'85 U.S., one boliviano is worth 38'8 cents, which basis has been used.

The above descriptions are based on data obtained in the examination of the properties of the Compañía Corocoro de Bolivia, and through the kindness of the general manager of the Corocoro United Copper Mines Ltd., and his staff.

The Mineral Production of Japan during the first five months of the year 1912 is given in the accompanying table. An increase of 6'8% in the gold production is shown, as compared with the same period of 1911, 11'1% in silver, 8'5% in copper, 12'9 in coal, and 8% in sulphur. There were decreases of 6'1% in iron and 6'4% in petroleum.

	May	Year to date
Gold, ounces.....	1,035	55,500
Silver, ounces.....	402,310	1,921,700
Copper, pounds... ..	9,459,250	49,199,380
Iron, long tons.....	49,200	231,400
Coal, long tons.....	1,456,377	7,038,077
Petroleum, gallons...	6,756,080	22,165,760
Sulphur, long tons...	3,850	16,000

DISCUSSION

Our readers are invited to criticise anything appearing in this magazine and to discuss other subjects of general technical interest.

Phantom Profits.

The Editor :

Sir—Your recent articles under the above heading, though both useful and instructive, seem to me too much one-sided to be allowed to pass without comment. While appreciating your constant endeavour to impress upon engineers the importance of avoiding the misuse of terms, I consider your efforts on this occasion have led you to fix too narrow an interpretation on the terms 'cost' and 'profit.' I should like to say a few words thereon from the engineer's standpoint.

Fundamentally, the duty of the mining engineer and the metallurgist is to make the largest possible monetary return to the owners of the property that he may be entrusted to work. Most of your criticism only applies to the methods adopted by directors and auditors, but the engineer is concerned with anything which affects the welfare of the industry by which he lives. As engineers we should support any movement toward the enlightenment of shareholders, and your articles must do a certain amount of good in that direction, more particularly as they have been largely quoted by newspapers which come into the hands of shareholders. The great majority of mining shareholders are, however, quite aware that so-called 'working profits' and 'dividends' are not the same things, but they probably do not know how widely they may differ. They are no doubt prone to judge the contents of the barrel by the apples on top, and it is well they should be warned that, in the absence of any guarantee to the contrary, usually the apples below are not of equal quality. It should be noted, however, that the only harm done is in the mental disappointment; they receive their fair share of the good apples. You would reverse the process and hide the good apples at the bottom; then judging again from the appearance on top they might be induced to sell to a more enlightened person at a low price, and thereby suffer a real injury. Your methods would not give rise to large dividends, neither would they free the shareholder of all possibility of misconception.

The shareholder ignorant of accounts, or the one who will not take the trouble to consider whether capital expenditure is or is not included in working costs, cannot be properly safeguarded by any system. It is nevertheless of importance that every statement put before

him should be as clear and concise as possible, but I doubt whether the simplicity you advocate is advisable or practicable. Among other things you require that all capital accounts shall be closed, on the grounds that improvements do not constitute a liquid asset. Whether liquid or not, an asset remains an asset; any improvement is an asset unless it is merely in the nature of a replacement or a renewal. Certainly with most mines the expenditure on improvements is approximately equal to the deterioration, and in cases of plant very little harm would be done by charging all improvements to working cost and writing nothing off for depreciation; but at times this is not so. A mine can and often does, increase its assets in the way of extra development or plant, and to ignore this fact in making up the balance sheet is to acquire a secret reserve, which is a delusion and a snare. I have in mind an instance of this, which I will relate in illustration of the point.

A company owned two mines not far apart, which we may name A and B. At mine A was a 40-stamp mill and for a number of years each mine supplied ore for half of the mill; the working costs were about 20s per ton. A new manager arrived who reduced the working costs to 10s per ton, which had the indirect effect of increasing the ore reserves so enormously that it was decided to erect an 80-stamp mill at B. Accordingly all stopping was stopped at B and development pushed to make it ready for its large new mill. By the time the new mill was ready the ore reserves of the two mines had been increased by about 500,000 tons; but the cost of all the extra development was, on a plea of 'sound finance,' charged as costs against the yield of the 40-stamp mill. The outside shareholders thus got the impression that working costs were about 16s per ton, but those on the spot knew perfectly well that this was a fictitious figure, and that when the new mill started costs could no longer be loaded with the cost of excess development work. They realized that the true cost was about 10s, and accordingly had a higher opinion of the future prospects of the mine than the ordinary shareholder had, and they considered the shares worth buying. The shareholders who sold were deceived by such methods of accountancy; they did not know of the excellent apples that were at the bottom of the barrel.

There is also another side of this story which touched the engineer who brought about the reduction in costs. It so happened that he left the property at the time the new mill started; his successor received over 10,000 tons of

development ore already at grass for nothing and could not help having costs as low as 10s per ton. Thus to the public the man who had done all the work appeared to have had working costs of 16s per ton, which his successor had reduced to 10s. This you may consider made no difference to the pockets of the shareholders, but it probably did, because had the engineer received the proper recognition and reward due to him he might have stayed longer and effected further economies. The shareholders probably received less in dividends than they would have done their had mine *not* been run on the lines you advocate. I do not believe that you can claim that anyone will ever receive large dividends if your methods are adopted.

I am well aware that items are often charged to capital account to an extent which is scandalous, but the remedy is to check such abuses and not to close the door entirely to all expenditure on capital account. The engineer should not be tempted to neglect mine development, though he usually requires a strong curb on his expenditure on plant.

I have also some words to say against your proposal to abolish the use of the term 'operating cost' or 'working cost.' In my opinion the mining engineer should object to part in this way with what almost amounts to his birthright. He has no control whatever over directors' salaries, London office expenses, interest payments, depreciation of investments, and the declarations of dividends, and will avoid trouble by keeping himself clear of them. In the case of a new company the promoter may make use of the engineer's 'operating profit' in a misleading manner, but better that than he should make an allowance for London expenses, &c., and find later on that the directors receive bigger fees than he calculated upon, that they are paying interest on borrowed money, or that they have to write off a considerable loss on 'investments,' all of which would falsify his estimate of profit. In the case of an operating company the engineer's business is to do his work as cheaply as possible, and to restrict all expenditure on capital account to what is properly remunerative, and it is to his interest to keep the figures representing his own work separate from others for which he is not responsible. I further contend that it is to the interest of shareholders to encourage the capable and economical engineer by allowing him to place his own figures before them. In many cases the good work of an engineer would be quite lost sight of should your views become prevalent; he is not usually a well paid man who is contented to re-

main where he is for the rest of his life, and in such case he would readily lose ambition and with it his energy and zeal, and the shareholders' dividends would suffer thereby. 'Operating costs' are of great value in comparing the work of one mine with another.

In conclusion I need hardly say that my chief object in writing is to plead for the continued use of the terms: (1) operating cost at mine; (2) gross profit; (3) expenditure on mine development, and (4) mine development redemption. If the shareholders do not readily understand the meaning of these terms, we must do our best to use them in such a way that they can hardly be misunderstood.

S. J. SPEAK.

London, August 2.

The Editor:

Sir—I have read your articles appearing in recent issues under the above heading with much interest. You state that "the true profit is the final balance remaining for dividends after deducting all expenses at mine or office."

I gather from further remarks in your articles that you include in the expenses of the current year both the cost of development and of construction. It seems to me that the "true profit" of a mining company is the sum total of the returns to the shareholders during the life of the company less the share capital. Any single dividend is simply the distribution from time to time of accumulated surplus cash and is in the nature of a profit distribution at an intermediate stage. I agree that such distribution should bear as near a relation as is possible in these circumstances to the profit for the year, as far as can be ascertained.

Where cash is not available for capital expenditure, it may become necessary to re-invest a proportion of the profit earned for the purpose of more complete equipment and further development. The cash so lent to the mine, although not available for dividend, is profit all the same, and will be returned in due course if the mine 'wins out,' but should be written off year by year, until the particular items to which such profits may be allocated, finally stand in the books at such a figure, as will be realized on liquidation of the company.

The cash expended upon development, from whatever source derived, either from capital or from profits earned by the mine, should be redeemed, as is usually the case, by a fixed working-charge upon each ton of ore taken from the reserve for treatment. Such fixed working-charge is adjusted annually, and is ascertained by dividing the cost of the ore re-

serve by the tonnage. Ultimately, when all the available ore has been extracted, the development account is written-off and is replaced by cash.

Were it possible to write-off all other items of capital expenditure, month by month, in a similar manner, calculated upon the expectation of the life of the mine, plant, machinery, buildings, etc., so that when the mine is exhausted all items of capital expenditure would be represented in cash—such cash to be invested in gilt-edged securities; then all monthly returns would approximate to the true profit of the mining company. This we know to be impossible, and therefore the wisest course is to write-off most liberally and annually all items of capital expenditure.

If expenses for development and construction are debited to revenue account as and when incurred, as you appear to suggest, I fail to see how the true profit for any one year can be ascertained.

The reports criticized are apparently grouped under the following headings:

- (1) Reports by consulting engineers upon producing mines for the purpose of purchase.
- (2) Monthly reports usually cabled by the mine-manager.
- (3) Annual reports giving result of year's working and balance-sheets.

In the first case I should have thought that most engineers, in compiling estimated cost of future operations, would include an estimate to cover London expenses, depreciation, development redemption, insurance, taxes, and so forth.

The monthly report, which is usually cabled, expresses in terms of figures the mine-manager's efforts for the month. His working cost shows the result of all expenditure over which he has control and by which he can be judged. It is not his fault if the mine is saddled with say £100,000 of 6% debentures, which absorb part of his profits. It is not his fault if the London expenses are double what they ought to be. His cable being a monthly progress report must necessarily refer to an intermediate stage of the whole year's working, and his statement of profit represents obviously an intermediate stage of book-keeping. The responsibility lies with the directors, when publishing the cable, to make it clear to the shareholders as near as they can what charges are to be added to the mine cost.

As an example of 'phantom profits' from my point of view, the last annual report and balance-sheet of the Prestea Block A may be

cited: The issued capital of that company plus loans and accrued interest is £1,150,549, omitting odd shillings. There is a credit balance at Profit and Loss account of £2701 carried to balance-sheet. The Machinery and Plant and Buildings account stands at £364,375 of which slightly under 6% has been written-off for depreciation. The total expenditure on Mine Development stands at £340,028, and Expenditure on Shafts at £50,327. The ore reserves are estimated at 975,101 tons; each ton of ore has therefore cost 8s. to develop. The amounts charged for the year respectively to Development and Shaft Sinking in the balance-sheet are £60,720 and £10,547. I note, however, that only £14,805 of the first figure and nothing of the latter is debited to Profit and Loss account, and is equal to 3s. 2d. per ton milled. If this figure had been 8s. per ton, and if Machinery and Plant and Buildings had been depreciated by 10%—none too high a figure for West Africa—a loss would have been shown of £37,190.

The working cost at this mine are admittedly approximate to the yield in cash from the ore, and for this reason great care should be taken not to obscure the result, by making inadequate provision for writing-off these enormous capital charges.

But, so long as consulting engineers are not represented on the board of mining companies, they do not share with the directors the responsibility of creating 'phantom profits.'

ERNST LICHTENBERG.

London, August 1.

[A lengthy and most interesting contribution to this discussion by Mr. H. S. Denny is unavoidably held-over until our next issue.—EDITOR.]

Mining Schools.

The Editor:

Sir—I have just read the article by Mr. Edgar Rickard in the August number of the Magazine, entitled 'An Excursion in Cornwall,' with very great interest.

The placing of our mining schools in a position for testing "new devices designed to improve mining and metallurgical methods," would in my opinion develop a branch of educational work of first-class importance; not only for students, but also for the advancement of the industry at large, for two good reasons:

First, because it would prevent the rising generation of students from falling into grooves, and would familiarize them with fresh ideas and new machines by progressive stages.

Second, because it would tend to remove tests of this kind from falling under the suspicion of *ex parte* advertisement or prejudice, in statements made about the results of such trials.

And the publication of comparative tests of this sort would in many cases, I feel sure, be of the greatest possible value to the practising engineer in laying out new plant to meet special conditions in the best possible manner, thus contributing to the gradual progress of the profession from both an engineering and an economic standpoint, if conducted upon somewhat similar general lines to the trials carried out by the Mines Trials Committee on the Rand.

I drew attention myself to this matter in a paper I read before the Institution of Mining and Metallurgy, in April, 1911, entitled 'The Future of the Mining Industry from an Economic Standpoint' in which I urged the need for "practical mining and metallurgical research work" and "the need for an imperial school of mining and metallurgical economics," expressing the hope that the Imperial College of Science and Technology may, later on, devote their energies to the advancement of these ideas in London.

But it would obviously, I think, be an advantage if the mining departments of work of this description could be carried on in a mining district, like Cornwall; and in order to carry out such an idea fully and to make it of wide practical use (as is being done on the Rand) the schools of London and Cornwall ought no doubt to be brought into closer touch with one another.

A. G. CHARLETON.

London, August 18.

Oroville Dredging Co.

The Editor:

Sir—Having read in your issue of May last certain observations relating to the Pato property in Colombia, belonging to the above-named company, I feel in a position to offer you my personal observations in the matter. Quite recently on my way home from Colombia I had an opportunity of visiting the property and of seeing the dam, the hydro-electrical machinery, and the dredge, in course of installation.

To one who, like myself, knows the difficulties connected with initiating modern methods of working in Colombia, it is evident that capital progress has been made, and that the measures employed are the most practicable, considering the conditions of place and

climate. In my opinion any cheaper or temporary power-plant would not have proved advantageous. A steam-plant would have necessitated a large number of hands to supply the fuel, which, considering the inconveniences of the locality and climate, would have proved very costly. The hydro-electric plant is decidedly the cheaper, and the method of obtaining it, by means of a dam, is undoubtedly the correct one. It could possibly have been procured at a little less cost by making a long water-course, but this would have entailed constant expense in keeping it in order. Then again, owing to the frequent disturbances of the elements, there might be serious landslips to contend with, necessitating a large staff of men to cope expeditiously with such accidents. Should workmen be lacking, the company would run the risk of great losses through the enforced suspension of work while the landslips are being cleared. I would like to mention that I was very favourably impressed with the substantial and good class of work that is being done, and undoubtedly the company will, in the near future, be fully compensated for their present expenditure.

GEORGE E. TILLEY.

Croydon, August 8.

Prospecting.

The Editor:

Sir—In reading the recent numbers of your magazine I was rather surprised to find in an article on prospecting* that the writer apparently had a profound contempt for reasoning by analogy or theorizing. It would be interesting to know what was the country-rock he considered unfavourable to the existence of precious metals; in which, however, he had found rich deposits of such metals.

It is quite obvious that "prior to development there is no law, written or unwritten, enabling a man to determine either the extent or value of an auriferous deposit" or, I might add, any other deposit. In fact, I might go so far as to say that it is desirable, at least, to have a look all around any substance, whether a mineral or not, before deciding as to its quantity or value.

Once a deposit has been trenched, sufficiently deeply, across its course at reasonable distances, much can be foretold, after an intelligent inspection, by one who has made a real study of types of ore deposits. A "real study" implies work in the field and many miles of travel, as well as reading and work in the laboratory.

* "Prospecting." By John McCombe. *The Mining Magazine* February, 1912, page 136.

Of course, if the condemnation or approval of the mineral possibilities of a country is made by "so-called mining experts," by which I presume is meant men with no real claim to the title, it is of no value, but, if made by men who have studied their subject, then they will undoubtedly know whether they have seen enough of a country to make a report either adverse or favourable.

It sounds odd to hear of hundreds of feet of driving being done along the line of likely-looking veins traversing a "splendid class of country," from which veins many a colour of gold could be obtained, and I feel tempted to ask whether this was done by so-called mining experts or by diggers of the where-it-is-there-it-be type, for no man who had made an intelligent study of ore deposits would drive hundreds of feet along barren veins.

That profitable ore may be confined to a rib on either side of a vein or deposit, may be scattered through it, or occur in bunches, is all known to the mining geologist, who also knows the reason for it. Obviously, there are many things that are hidden from the mining geologist before extensive development, but these are mostly matters of quantity; they are equally, if not more, hidden from the old diggers, so that the odds are greatly in favour of the former, while in the matter of deciding rapidly upon the prospective value of large areas of country, the geologist must leave the old diggers far behind. The reference to Dame Nature's laboratory is rather puzzling to the mining geologist, who must have worked in an ordinary laboratory also; my own idea is that we have many students educated in Dame Nature's laboratory, that the number is daily increasing and we are cognizant of the work carried on therein. The Dame has kindly left some of her work incomplete, other of her work is still proceeding and many of the chemicals used in her processes are to be seen by those who have eyes to see such things. It is no more necessary or desirable to have been down below at the period of primary formation or secondary concentration of minerals in order to know how they have been formed, than it is necessary or desirable to be inside a retort or crucible at the time of active operations to know what is happening or has happened.

If you take a man into a metallurgical laboratory who has never previously been in such a place, where experiments or estimations are proceeding, he will remark probably that there is a bad smell, a funny smell, or that some of the bottles contain pretty chemicals, the glasses are thin, the furnaces are hot, and so

on; but a trained man, when he looks at the chemicals being used, will have a fair idea of what is being done. It is precisely the same in Dame Nature's laboratory; those who have not been trained, do not recognize it as a laboratory, while those who have been trained can tell what has happened, and what is still happening, even if it is only, so to say, the washing-out of apparatus to start a fresh process elsewhere. The *bona fide* prospector should be encouraged in every possible way, so also should the engineer or mining geologist who by choice or force of circumstances takes up pioneer work. The mathematician has probably worked harder and should be encouraged at least as much as the man who counts on his fingers.

I hope that nothing in my letter can be considered as unkind, for it was my intention only to be critical.

STEPHEN J. LETT.

London, August 23.

Hemp Ropes.

The Editor:

Sir—On page 127 of your August number you speak of the use in olden days of hemp capstan ropes of 6 inches diameter for mining purposes, and as being efficient only for shallow depths. Naturally, such ropes have been superseded by steel ropes of smaller diameter. But the following extract from the accounts of Great Wheal Vor may be of interest. This rope was nearly 6 inches in diameter and I estimate it to be 320 fathoms, or 1,920 feet, in length—not altogether a shallow depth.

"25th July, 1854—a 17-inch patent capstan rope made of the best topped hemp. 205 cwt. 3qr. 12lb. at 50s. per cwt., £514. 12s. 10d."

FRANK HARVEY.

Hayle, August 23.

Cornish Tin Ticketing.

The Editor:

Sir—I read with interest Mr. Harold E. Fern's article on the Cornish tin ticketing, and I think he deserves the thanks of all interested in Cornish mining for bringing the matter forward and for presenting such a mass of facts from actual practice.

Mr. Fern refers to an article appearing in your January issue in which you suggest that water might be added to the parcel after the sample was taken and that the smelter might be paying for water at the price of tin. When reading this I was unable to suppress the same smile that Mr. Fern referred to. I am compelled to say that such a suggestion im-

plies an under-estimate of the smelter's methods and ability; they are not likely to be deceived as easily as that. The smelter, like the Jew in the 'Merchant of Venice,' sees to it that he gets his pound of flesh; in this case three pounds of black tin per hundredweight.

With your permission, I will give the method in use in other parts of the world, and will leave you to compare it with the Cornish method as described by Mr. Fern.

A parcel of concentrate is ready for sale. It is dried, passed through a fine screen, and mixed thoroughly. Three samples are taken; one is sent to the smelter (if no representative is present); one is sealed and sent to a referee, should a dispute arise; and one assayed on the mine. If the mine and smelter agree as to the percentage of metallic tin, the parcel is sold on the basis of the tin standard for that day. If there is a difference of over 1%, the third sample is sent to a referee and the percentage is calculated on the mean of the nearest two. Smelting charges and penalties are deducted on a scale agreed and the mine-owner knows within a few shillings per ton what his ore is worth.

It is sometimes the case that the mine-owner takes a sample of the ore before dispatching it to the smelter, and the smelter takes two samples on delivery, one for a referee if necessary. The principle is, however, the same; and if sufficient care is taken, the results are very close. The smelter also agrees to pay a higher price per unit for the ore if it exceeds a certain percentage; consequently it pays the mine-owner to dress the ore to as high a grade as is possible without involving undue loss. The moisture is also determined exactly and not averaged, so that the mine gets paid for the actual weight of the ore. The percentage of metallic tin in the Wheal Kitty & Penhalls concentrate, ranging from 70 to 72·86%, was unusual; if the concentrate contained no impurity in the form of sulphur, copper, or arsenic, the price paid by a foreign smelter would be an exceptionally high one, anything over 70% being paid for at a higher price per unit.

It has always been an enigma to me why the smelters in Cornwall always deduct the same amount for moisture. The method may work out quite satisfactorily for the smelter, but surely it cannot be fair to the mines. As you are aware, some of the mines in Cornwall are several miles from the smelting works and others only a short distance, and on a wet day—and a wet day is no unusual thing in Cornwall during winter—the percentage of

moisture must vary, yet the same amount is deducted from the gross weight in winter or summer, wet weather or dry. Would it not be more satisfactory to determine the percentage of moisture and deduct the actual amount?

The statement made by Mr. Fern that the smelter bids are dependant on whether they are short or not of the class of ore offered shows, to say the least, the existence of a very unbusinesslike method of procedure, and as a consequence some mine or mines must suffer; during the period reviewed by Mr. Fern it was undoubtedly Wheal Kitty & Penhalls. I find from Mr. Fern's charts that the average price for tin during the period reviewed was £194·5 and the average metallic tin content in the Wheal Kitty & Penhalls concentrate was 71·65%. On the basis of £194·5 per ton, the Wheal Kitty & Penhalls concentrate would be worth £132·19. If sold to a foreign smelter and it contained no impurity, it would realize £122·19, after the deduction of smelter charges of, say, £8, which is on the high side, and other usual items. Yet the Wheal Kitty company only received an average of £116·54, after allowing for draftage, which Mr. Fern calculates to be equal to £3 per ton. Under these conditions the Wheal Kitty company stood to lose close on £9 per ton.

AMOS TRELOAR.

Rooiberg, Transvaal, July 20.

The Editor:

Sir—The information given by Mr. H. E. Fern and Mr. Amos Treloar in connection with the sale of tin concentrate in Cornwall and elsewhere has been helpful in the campaign against old-fashioned and illogical methods of business, but I desire to question their statement that the 3 lb. draftage is intended primarily as a protection to the smelter on the score of moisture present. As I pointed out in a contribution to the pages of the magazine in the issue of January 1911, entitled 'Buying Water at the Price of Zinc,' the buyer allows for the presence of moisture by offering a correspondingly lower price for wet than for dry concentrate. It is possible that the draftage of 3 lb. may be an additional protection against any variation in the moisture-content subsequent to sampling, but its real origin is to be found in the old-fashioned custom of always giving a little more than the exact amount. The custom is still extant in the 'long-pull' at the public house, and the 'heaped' gallon or peck of fruit and vegetables.

EDWARD WALKER.

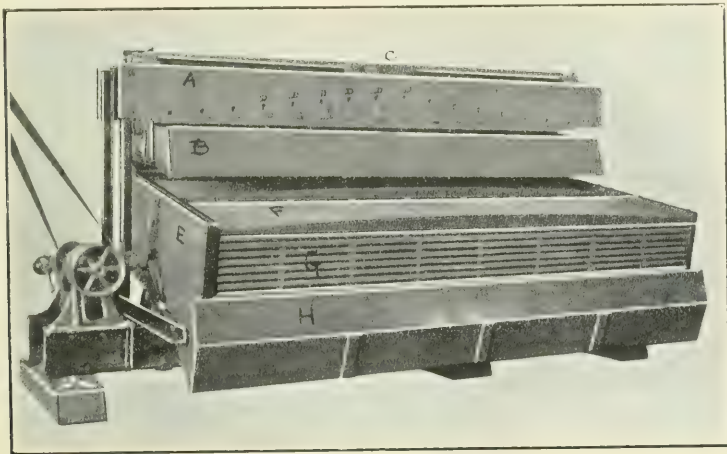
London, September 1.

PRÉCIS OF TECHNOLOGY

Multiple-Deck Slime-Concentrator.—*Mining Science* for July 25 describes the new slime-concentrator invented by A. R. Wilfley, of Denver, and recently adopted at the Miami, Utah Copper, and other copper mines in the western States. It consists of a series of 12 tables imposed one over the other in a frame; these receive the usual longitudinal oscillation, and are also arranged to tilt laterally. The series of tables do not treat the same slime over and over again, but receive their feed from one distributing-box. The object of this multiplication of treatment-surfaces is to increase the capacity of the machine, and not to increase the amount of surface to which the slime is exposed. The decks measure 6 ft. wide and 12 ft.

accumulate in the grooves. During the next period the distributing-box tips backward so that the pulp ceases to flow to the decks, and the decks tip to a greater angle toward the discharge side; the water of the pulp continues to flow from the distributing-box and washes the gangue from the decks. At the third period the decks tip to a steeper angle and a flush of fresh water coming direct from the box (A) removes the concentrate from the grooves. In some of the machines, the 12 decks are arranged in tiers of 6, each set working in an alternate part of the cycle.

Rolls versus Stamps.—In his presidential address to the South African Institute of Engineers, as reported in the *South African Mining Journal* for July 20, James A. Yule made a suggestion for the use of rolls in place of stamps for effecting the coarse crushing



WILFLEY'S MULTIPLE-DECK SLIME TABLE

long, and are spaced $1\frac{1}{4}$ in. apart. They are covered with linoleum, which has been grooved longitudinally; each groove is $\frac{3}{8}$ in. wide and $\frac{1}{16}$ in. deep, and the surface separating them is $\frac{1}{2}$ in. wide. The decks are fixed in end-frames (E) and are open at the front (G) for the discharge of concentrate and tailing alternately. The treatment of the slime is watched on the top surface (F) and the arrangement is such that the action on each lower and unexposed surface is the same. The feeding apparatus requires careful design so as to insure a regular division and distribution over all the surfaces. The upper feed-box (A) is stationary, and the lower distributing-box (B) tilts in unison with the tilting of the series of tables. The tables receive a longitudinal oscillation at 225 r.p.m. and a cam controls their tilting motion and the movement of the distributing-box. Below the tables is a box (H), which automatically distributes the concentrate and tailing to their respective launders. The tables work in a cycle of operations occupying about a quarter of an hour. During the first period the pulp is spread over the decks, and the longitudinal oscillation of the decks causes the heavier particles to

now generally adopted on the Rand. As is well-known the tube-mill is universally used in all new plants on the Rand, and has been added to most of the older installations at mines likely to have a sufficiently long life to warrant the expenditure. At the same time the battery-screens are being made coarser, and the stamp-duty correspondingly increased. In many cases amalgamation below the stamps has been abandoned and is done solely below the tube-mills. The increased duty of the stamps necessarily makes the amount of water used correspondingly greater, and at the present time, after a season of meagre rainfall, the question of shortage of water is a serious one at many mines. Under all the circumstances, Mr. Yule asked his hearers to consider whether other methods of coarse crushing could be advantageously adopted. We quote his remarks in full as follows: "Two or three-stage crushing might be introduced, the product from the last stage being cubes of $\frac{3}{4}$ in. or less; this product to pass through rolls, which would crush to the fineness required by the tube-mills, say to pass a screen having 9 or 12 holes to the square inch. Trommels would be used to separate all the finely crushed material at each

stage. Presuming that steel for the shells could not be obtained to withstand the abrasion without excessive cost for spares, it is possible that some form of shell, designed on the lines of one of the patent tube-mill liners, could be made at a low enough cost, so that renewals and repairs would be lower in price than the spares and repairs of a gravity-stamp installation of the same capacity. It would pay the various mining groups, especially those who contemplate opening up new properties, to contribute to a common fund to investigate this matter, and allow, say the Mines Trials Committee, to experiment with rolls having shells made of different material and construction and to test the crushing efficiency of such machines. In such a system of coarse grinding there would doubtless be a considerable reduction in water requirements, and return-pumping power would be incidentally reduced, a considerable and constant item on most properties. To reduce water requirements further, and at the same time accelerate the extraction of gold, I see only one reason why the cyanide solution should not be introduced in place of water at the crushing rolls; my one single reason against this I will mention later. For sliming purposes it would be advisable to have the crushing plant so situated in relation to the sand and slime plant as to allow an ample fall necessary for a system of classification; otherwise the cost of power for re-elevating the pulp might be excessive. All amalgamation could be abandoned if the above system were adopted. It is said by some authorities that rolls would not be economical for large daily tonnage, but I think that with careful design rolls would prove more efficient for coarse crushing than the gravity stamp, on a basis of the average crushing capacity of the mines on the Rand. The capital cost of a plant on the above would be considerably less than that of the present-day plant, besides which there would be a great reduction in attendance, power, labour, and repair costs. In power costs there would be, I think, a great saving. More tube mills would be required on account of the coarseness of the product being increased, but even allowing for the additional power required for tube-mills and crushers used in conjunction with the rolls, there would still be a saving. Collecting tanks for sand would not be required, which means a saving in capital and working costs. If solution were used instead of water, the design of plants would have to be such that the loss of solution would be reduced to a minimum. It is doubtful whether the required minimum loss of solution could be attained. On this account it is possible that the use of solution in the place of water in the tube-mills would not be available. This is the one reason which leads me to doubt whether solution would have an advantage over water if introduced at the tube-mills. Other forms of coarse grinders than rolls might be found more satisfactory, especially if made in large units. The merits of the various types of grinders could be considered, to meet the circumstances, of each particular position."

Solubility of Gold in Nitric Acid. The *Bulletin* of the American Institute of Mining Engineers for July contains a paper by Edward Keller on the solubility of gold in nitric acid when conducting the 'combination' method of assaying copper bullion, in which nitric acid is employed as a solvent for the copper. The loss of gold by this method has been discussed by Ledoux, Van Liew, Flinn, Pufahl, and others, who have offered various explanations, such as the action of nitrous acid and selenium, and the mechanical loss of fine particles of gold through the filter-paper. Mr. Keller brings forward another explanation, namely,

that the solubility of the gold is affected by the rate at which the ingot or slab is cooled. The slower the cooling, the more gold is soluble in nitric acid. He made this discovery while assaying a number of castings, of different sizes, from the same converter product. The larger castings that took longer to cool showed a smaller gold content than the small pieces that had cooled rapidly. As an explanation of this phenomenon, Mr. Keller is of opinion that during slow cooling the gold enters into some chemical combination with the other metals present, in which form it is more readily soluble in nitric acid than if it had been segregated by rapid cooling.

Sulphuric Acid Manufacture.—Nowadays smelters are obliged to study the question of preventing the escape of sulphurous acid, and in many cases have erected sulphuric acid works. The paragraph in the Annual Report for 1911 on Alkali Works contains a reference to the Opl method of manufacturing sulphuric acid, that has recently been adopted at a works in England. The process has been in operation at Hruschau, Austrian Silesia, for three years or so. It is described as the manufacture of sulphuric acid by means of towers to the exclusion of leaden chambers. By this method chambers are entirely eliminated, a series of towers worked in sequence being substituted, and the reactions are brought about by the rapid circulation of the nitrous sulphuric acid through the towers meeting the sulphurous acid. The sulphuric acid is elevated and atomized in the towers by means of the emulsion, and this emulsion is effected by compressed air. As stated by the patentees, the movement of the acids in the tower process is consequently based upon the methodic circulation of the nitrous sulphuric acid of the last towers on the first towers, and the re-circulation of the de-nitrated acids of the first on to the last ones. A fan is placed behind the last tower in the series to effect the necessary movement of the gases from the burners through the towers. It is claimed that comparing the tower system with a chamber system of equal production, the total space of the towers represents about one-tenth of the volume of the chambers. For works with limited area available, this process will be acceptable, as the floor space occupied is about one-quarter of that usually required.

World's Iron and Steel Production.—The *Engineering and Mining Journal* for August 3 publishes its annual estimate of the production of pig iron and steel throughout the world. The total production of pig iron during 1911 was 64,251,217 metric tons, as compared with 65,860,260 tons during 1910, the decline being due chiefly to the lower output in the United States. The three chief producers are the United States, Germany, and Great Britain, with 37.4, 23.8, and 15.4% of the total output respectively. The following table gives the output of these three countries and of the world during 1910 and 1911:

PIG IRON PRODUCTION OF THE WORLD IN
METRIC TONS.

	1910	1911
United States.....	27,636,678	24,027,733
Germany	14,794,029	15,280,527
Great Britain.....	10,380,212	9,894,136
Total	52,810,919	49,182,396
All other countries....	13,049,312	15,068,821
Total	65,860,260	64,251,217

The production of steel during 1911 throughout the world was 58,386,921 metric tons, as compared with 58,252,347 tons in 1910, thus showing a slight increase.

The United States figures were lower than in 1910, but other countries show a uniform advance. The increase in the figures for Great Britain indicate that not so much wrought iron was produced. Only Great Britain and Belgium are now producers of substantial amounts of wrought iron. The following table gives the figures for 1910 and 1911:

STEEL PRODUCTION OF THE WORLD IN
METRIC TONS.

	1910	1911
United States.....	26,512,437	24,054,309
Germany.....	13,698,638	15,019,333
Great Britain.....	6,106,856	6,564,998
Total	46,371,921	45,638,640
Other countries.....	11,934,426	12,748,281

Total 58,252,347 58,386,921

From 1902 to 1912 the pig iron production of the world advanced by 19,908,648 metric tons or 44.9%, and the steel production by 26,936,779 tons or 85.6%. These figures show clearly the displacement of wrought iron in favour of steel.

It is of interest to compare the Journal's figures relating to pig iron with those published by the British firm James Watson & Co

	1910 Long Tons	1911 Long Tons
United States.....	27,298,545	23,649,344
Germany.....	14,793,325	15,535,112
Great Britain.....	10,216,745	9,718,638
France.....	4,032,459	4,508,022
Russia.....	12,956,000	3,521,000
Austria and Hungary..	1,990,684	2,089,867
Belgium.....	1,803,500	3,074,843
Sweden	604,300	633,800
Spain	425,000	437,000
Canada	740,241	824,345
Italy	343,600	254,322
Japan	1162,000	1162,000
India	35,933	49,183
China	120,000	110,000
Mexico	45,000	70,096
New South Wales.....	40,487	36,354

Totals 65,697,788 63,698,926

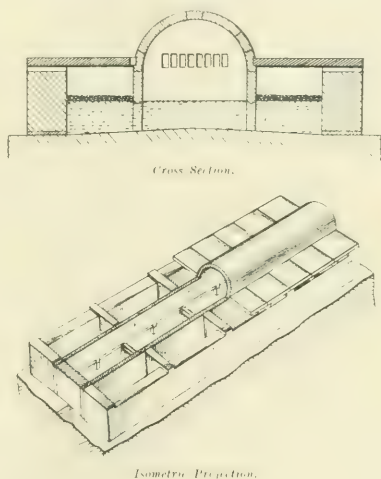
¹ Estimated

In making the comparison it must be remembered that the metric ton contains 2204 lb., and the long ton 2240 lb.

French's Zinc Process.—A good deal has been written in the press recently regarding the process invented by A. Gordon French, of Nelson, British Columbia, for the purpose of treating the mixed sulphide ores at Slocan and elsewhere in the Province. Some particulars are given in the *Canadian Mining Journal* for July 15, and by W. Fleet Robertson in the Annual Report of the Minister of Mines for 1911 just issued. From these accounts the novelty and commercial value are not apparent. The material on which Mr. French has worked contains blende, galena, pyrite, and siderite, together with some quartz and shale gangue. After crushing to 10-mesh, a nearly dead roast is given. Afterwards about 5% of nitre cake, that is, bisulphate of soda, is added and the charge heated for 15 minutes. The oxides are thus converted into sulphates. The charge is then removed and cooled, and transferred to a wooden leaching vat. Here acidulated water is added to dissolve the remaining oxides and the sulphates of zinc and soda. The insoluble lead and silver compounds remain in the vat. It is stated that the iron compounds do not commence to

dissolve until all the zinc is dissolved, so that they can be left behind. The solution containing the zinc is run into another wooden vat where it is electrolysed between sheets of zinc and lead. The zinc is deposited on the zinc electrode, and any manganese in the ore is deposited as black oxide on the lead poles. Mr. French's plant is a rough, experimental one, with a capacity of only 500 to 1000 pounds

Zinc Metallurgy. In *Metallurgical and Chemical Engineering* for August, F. L. Clerc proposes to construct a zinc-distilling retort with a molten-copper bottom, and to introduce the heat required for the reaction through the copper instead of through the fire-clay walls. The accompanying cross-section and isometric projection show the arrangement. The retorts are built of fire-brick in two rows, communicating with a central longitudinal heating-chamber. The floors of the retorts and heating-chamber consist of molten copper, the level of which is just high enough to seal the retorts from the heating-chamber. The heat is intro-



duced into the heating-chamber by the medium of a flow of burning gas, and it is carried by conduction through the copper into the retorts. The charge is introduced, in the form of briquettes, through the roof, and the escaping zinc and gas are carried through apertures in the sides to the condensing chambers. The process is presumed to be continuous, and the briquettes contain nothing that will be left behind as a residue. Therefore the briquettes must consist solely of zinc oxide, and a carbonaceous material free from ash. The absorption of zinc by the copper bath is also a question requiring consideration.

Indian Magnesite.—The *Journal of the Royal Society of Arts* for July 26 contains a paper by C. H. B. Burton on the magnesite deposits of India, particularly those at Salem, half-way between Madras and Calicut. These deposits have been known for many years, but their commercial development has been only of recent times, and has been due to the energy of H. G. Turner, who was also a pioneer in Indian manganese production. The Salem magnesite is found in

the form of so-called 'chalk-hills,' in the midst of a country composed largely of dunite, which shows all the varieties of decomposition usually associated with olivine and serpentine. An average sample of the dunite gives the following percentage composition: Silica 3.91, magnesia 48.26, and the remaining 12.64 composed of iron, aluminium, manganese, and chromium compounds. C. S. Middlemiss, at one time head of the Geological Survey of India, has described these deposits and has shown how the dunite in places has been altered by the olivine constituent becoming serpentinized, leaving the chromite segregated as nodules and veins, and subsequently the serpentine being gradually changed to magnesite. The amount of magnesite ready for extraction by quarrying is estimated at 1,000,000 tons, and it can be divided into two classes, the first grade containing over 90% $MgCO_3$ and about 1½% silica, and the second containing from 80 to 90% $MgCO_3$ and 10 to 11% silica. The magnesite of both classes has a large application in the manufacture of cement, for which purpose it is given a light calcination at 700 to 900° C. It is claimed by some chemists that the dunite itself can also be used for the manufacture of cement if suitably burnt and mixed with magnesia, but further information is required on this point. Only the purest magnesite can be used in the manufacture of the lining for basic metallurgical furnaces, and this has to be dead-burnt at 1700° C for a sufficient period to dissociate all the carbonic acid. A typical magnesia produced from these deposits and sold for the manufacture of basic linings and fire-bricks contains 93.12% magnesia, 4.38% silica, 1.02% ferric oxide, 0.10% alumina, and 1.04% lime. This is produced in gas-fired kilns. It is in demand in Europe and America, and it is to be adopted at Tata's new steel works at Kalimati, India. Mr. Burlington's paper gives a great deal of information about these and other applications of magnesite.

Geology of Ecuador.—The *Mining and Scientific Press* for July 27 publishes an article by W. A. Wolf and Tedore Wolf on the geology of Ecuador. The accompanying map shows clearly the distribution of the rocks. Generally speaking the eastern range of the Andes consists of Archaean rocks, while the coastal regions consist of Tertiary deposits; between these two, the western range of the Andes and the inter-Andean region consists of Cretaceous sedimentaries and eruptives. The igneous rocks may be divided into three classes according to the period of their formation: (1) granite and syenite associated with the gneiss and crystalline schist of the Archaean rocks; (2) greenstone and porphyritic rock intruding the Cretaceous deposits; (3) volcanic and plutonic rocks associated with the Tertiary and Quaternary deposits, the volcanic rocks preponderating in the north and the plutonic in the south.

The eastern Andes is composed mainly of rocks belonging to the Laurentian group, including gneiss, schist, and slate of a crystalline texture, the petrographical character of which has been changed by metamorphic action. The raising of the Andes was effected in recent times, later than the Cretaceous and probably in the Tertiary period. The principal framework of the Andes has been subjected to changes from Archaean times to the present day, causing many alterations, both chemical and structural. The main agency of change has been the eruptive rocks, which thrust themselves through the strata. The later rocks of aqueous origin overlie them so much that their area of outcrop is limited. The surface exposure of the gneiss and crystalline schist extends through the eastern range on its eastern slopes from Peru to Colombia. In the province of Loja gneiss and schist are prominently de-

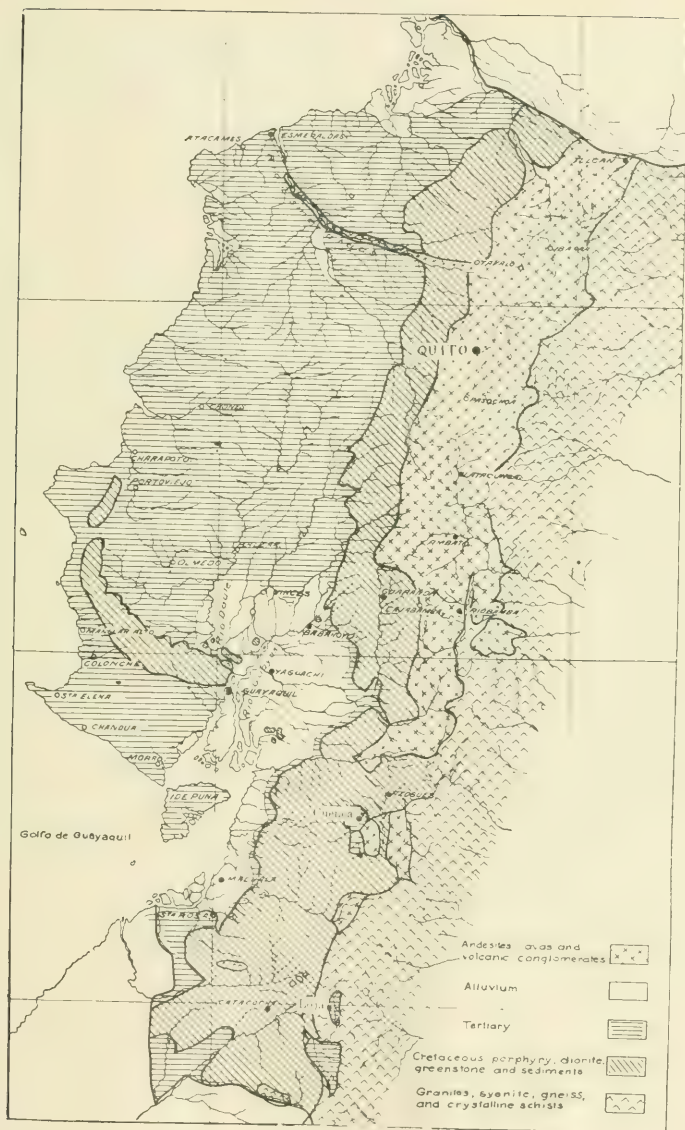
veloped, and descend by the western slopes to the deep inter-Andean valleys.

True granite is found in few places. It is sometimes found intercalated with gneiss and micaceous schist, but in these cases it is frequently difficult to distinguish from a gneiss badly developed. Syenite is found more frequently than granite, but under similar circumstances, and never is extensive. Like the granite found with the gneiss, the syenite is in close relation with the amphibole schists, this relation without doubt being genetic. Mica characterizes the granite and the gneiss, as hornblende marks the syenite and hornblende schist. Diorite in the province of Loja is found as dikes in the granite and syenite.

The geological scale is not fully represented in Ecuador, the Palæozoic and the first two periods of the Mesozoic being wanting. No trace has been found of any formations of these periods. Wherever contacts of Archaean rocks with others have been found, formations of Cretaceous or younger age rest upon the Archaean. In Colombia and Peru, Jurassic and even older rocks are found, and it is possible that they may be yet discovered in the deeper synclines, covered with later strata, or in some region not yet studied. According to deep artesian-well borings, the Cretaceous formation of the coast near Guayaquil appears to rest directly on the crystalline schist and granite. The boundaries of the Cretaceous are ill-defined, and it is hard to determine the age of certain strata. Fossils are almost entirely wanting. In the majority of cases, it is necessary to classify the rocks by analogy and by comparison with similar rocks in other countries. In the inter-Andean country the Cretaceous is not extensive, being covered in many places by volcanic material. In the western range it is highly developed. The beds of the Cretaceous are irregular and have been uplifted and folded. The dip is mainly toward the west, and the strike is that of the range.

Greenstone and porphyritic rock are found chiefly in the southern provinces. In the northern part they are deeply hidden below volcanic rocks. Andesite, containing veins of gold quartz, is found in the southern provinces.

Quartz veins are found in the schist, gneiss, and slate formations, generally without associated minerals, though sometimes oxides of iron or manganese occur. No auriferous quartz is found in these formations. The relative poverty of the veins in the primitive formation and in crystalline rocks is striking. At Gualaceo, far across the eastern range, gold-bearing quartz veins are reported. In silver the veins are as deficient as in gold. Notwithstanding the poverty of the veins the eastern range is an auriferous district because of its placers. Nearly all of the rivers have their source in the crystalline rocks. The majority of the gold-bearing streams have their source in the eastern watershed from the Loja province to the province of Imbabura, because on that side the schists reach their highest development. On the western side the gold washings are only in those provinces in which the schistose formations extend to the deep depressions of the Andes. They are richest in the province of Cuenca. It is not to be doubted that the gold found originated in the schistose formations, because the streams carry it in larger quantities and larger grains while traversing them, and as soon as they enter other formations, the gold content diminishes and the grains are smaller until it altogether disappears. The tributaries of the Napo, Santiago, and other great rivers are gold-bearing in their upper courses and barren below. In the province of Azuay the rivers do not contain enough gold to repay washing



THE GEOLOGY OF THE WESTERN PART OF ECUADOR
(From the Mining and Scientific Press)

Losses in Ore-Drying.—The July *Bulletin* of the American Institute of Mining Engineers contains a paper by C. F. Dietz and D. V. Keedy, discussing the losses during the drying of ores or concentrates. The losses during roasting and smelting have received much notice of recent years, but the present authors are the first to call attention to similar losses during drying, caused first by abrasion and second by the escape of the finer particles in the current of heating gases. In the early days of the cyanide process, before the introduction of mechanical methods of agitating slime, it was necessary to crush dry before cyanidation in order to remove the finer particles, but the loss in drying was as nothing compared with the waste involved in the discarding of what is now called the slime. Nowadays the chief reason for drying an ore is to make it amenable to magnetic separation, but there are also other processes where drying is desirable. The drying is usually done in a tower, in a revolving cylinder, or in a furnace with rabble-arms. In all cases the mechanical agitation causes abrasion, and the discharged material is therefore of greater average fineness than the feed, while the current of heating gases carries away a large amount of the finer material. As a rule the valuable mineral is softer and more easily reduced to fine particles, so that though the loss by weight during drying may be small, the actual loss by value may be serious. The authors give a number of instances where their investigations have provided definite information as to these losses. In one case the ore contained lead and silver, two-thirds of the lead being in the form of carbonate, and about 10% of the silver as chloride or other halogen compounds. The ore, after crushing to $1\frac{1}{2}$ in., contained only 5 to 8% of moisture, so the draught was kept low, and the number of lifting ledges in the rotating dryer was reduced to a minimum. From the dryer the gases went to a large chamber, and the discharge due to the stack was of ample dimensions. These precautions caused the flow of gases through the dryer to be slow. An examination of the ore, discharge, and material carried away gave the following results:

	Percentage by Weight	Assay	
		Lead %	Silver Oz.
Feed	100.00	10.36	9.68
Dry Discharge	96.20	9.77	9.34
Settled in Chamber ..	1.77	35.30	10.30
Settled in Flues & Stack	0.76	18.50	8.60
Lost in Gases	1.27	14.30	15.20

After quoting many more cases, the authors give in detail the details of their most recent investigation. The ore contained 20% zinc and 20% iron, the zinc being mostly in the form of sulphide, having some iron chemically combined with it, though most of the iron was in the form of pyrite, specular hematite, and magnetite. A small quantity of argentiferous galena was present. Some of the ore was oxidized, chiefly to carbonates of zinc, lead, iron, and manganese. The first experiment conducted with the rotating dryer was to determine the amount of abrasion. Ore weighing 2177 lb. passing a 2-in. ring, 83.7% larger than $\frac{1}{2}$ -in. mesh and all larger than 16-mesh, and nearly free from moisture, was passed through the dryer. About 50 lb. or 2.3% of the total weight was lost in the gases, and the 2110 lb. of dried ore discharged consisted of 74.4% over $\frac{1}{2}$ -in. mesh, 13.3% over 16-mesh, and 12.3% less

than 16-mesh. The amount of grinding done by the dryer was thus shown to be considerable. It was decided to instal plant to recover the finer material that would be carried away by the gases, and the construction of the rotating dryer was also modified so as to minimize the amount of mechanical action on the ore. The authors proceed to describe in detail the plant erected at this mine for the purpose of catching the dust from the crushing as well as the drying plant, and they give figures for the amount and assay-value of the fine particles caught.

Absorption of Water by Coke.—Experiments have recently been conducted in Germany with a view of ascertaining what proportion of water is absorbed by coke under varying conditions. The results of these investigations are given in *Stahl und Eisen* for June 13. The general deductions are that coke soaked in water will absorb up to one-sixth of its weight, but if only exposed to moist atmosphere absorbs little. The experiments were made at two separate works, on ordinary metallurgical coke broken into lumps of medium size. In the experiments for determining the absorption of water, the coke was first thoroughly dried, and after weighing, was immersed in cold water. After the intervals specified in the following table the coke was removed and re-weighed, the results on the coke from the two works being given in columns I and II:

Time of Immersion	Percentage Absorption	
	I	II
15 min	6.2	4.2
30 "	7.2	4.6
1 hour	7.7	5.2
2 "	9.1	6.6
3 "	10.1	7.7
6 "	11.2	8.7
12 "	12.9	9.9
24 "	14.1	10.9
2 days	15.9	12.4
3 "	17.2	13.5
4 "	17.2	13.5
5 "	17.3	13.6
6 "	17.4	13.6

In the experiments conducted with a view of ascertaining the hygroscopic property, the coke after drying was placed in a wooden chamber of 35 cu. ft. capacity, having a false bottom through which steam was slowly admitted. Some of the coke was removed at the intervals specified in the following table, which gives the percentages of water absorbed:

Time of Exposure	Percentage Absorption	
	I	II
6 hours	0.02	0.06
12 "	0.03	0.08
18 "	0.03	0.10
24 "	0.03	0.18
2 days	0.07	0.20
3 "	0.07	0.20
4 "	0.08	0.21
5 "	0.09	0.24

These results are of importance to metallurgists, as they prove that coke unless wetted does not absorb water to any appreciable extent.

Depths of West Australian Mines.—The *Monthly Journal* of the Chamber of Mines of Western Australia for June 29 publishes the following table giving the present depths of the chief gold mines in Western Australia. Unless otherwise stated the figures relate to the main shafts. It will be remembered that the lodes at Kalgoorlie are nearly vertical.

Associated.....	2286
Chaffers (Main Reef)	2274
Golden Horse-Shoe.....	2390
Great Boulder	2845
Great Boulder (Edwards)	2879
Great Boulder Perseverance	2200
Great Fingall (vertical and underlie)	2516
Ivanhoe	2660
Kalgurli	1900
Lake View Consols	2017
Sons of Gwalia (underlie)	2720
South Kalgurli	1818

* Depth from surface to bottom of winze from 13th level

Mine-Tributing in Rhodesia.—At the June meeting of the Chemical, Metallurgical, and Mining Society of South Africa, W. Anderson read a paper describing the conditions and circumstances governing tributing work at gold mines in Rhodesia. Properties let on tribute may be developed claims that do not hold out hopes of being sufficiently profitable for company requirements, or producing mines that have the same characteristics or else have come to the end of their profitable ore. The payment made is based on a percentage of the gross output, usually 12½%. Occasionally the payment is based on the content of the ore mined, the percentage payable rising with the content. The agreement as a rule fixes a minimum for the amount of work to be done, and the lease may be for months or years, the tributor having the right of renewal. In some cases, the company reserves the right to re-acquire the property at any time for a stated sum. The equipment of these properties varies greatly. Gravity stamps are usually employed, but steam stamps are frequently used, and pneumatic or 'air-cushion' stamps occasionally. Revolving mills of various types are used on soft ores. For power purposes, suction-gas plants are now largely used, but where fuel is cheap, boilers of the locomotive type are in favour. Wood fuel ranges from 8s. 6d. per cord upward, and charcoal from 2s. to 2s. 6d. per bag of 65 to 70 lb. The development of a small mine is started by sinking small shafts on the lode, the shafts following the changes of dip. In the case of ancient workings, the foot-wall of the old stope is followed downward to the lode. The usual size of shaft is 5 by 4 ft. or 6 by 4 ft. Close timbering is done by native labour down to the water-level. The first prospect level is driven at water-level which is generally at 60 ft., and the shafts are continued to 100 ft. and then connected. Lower levels are driven 50 ft. apart and developments are not usually far ahead of the mill. If the results warrant, a vertical shaft 8 by 5 ft. is sunk to cut the lode at 100 to 250 ft., timbered in the hoisting and pump-ways with 6 ft. setts made of native wood with pole lagging, and wire rope used for hoisting-guides. The head-gear is generally about 20 ft. high, and the hoisting gear is a single-drum with 2 ft. 6 in. pulley, ½ in. rope, and a ½ ton skip or bucket. As the lodes have usually a steep dip, 65° being common, the cross-cutting to be done is not great.

Development is slow, as a hammer-boy does not do more than 24 in. per shift in hard quartz. The monthly advance in drifts in quartz is 25 to 30 ft.; in winzes if there is no water trouble the rate is slightly faster. Stopping is usually underhand, using 24 to 36 in.

holes. Owing to development not being far ahead, the stopes are usually crowded, with the consequence that the benches are badly kept and the breaking efficiency reduced. Pillars are seldom left, and stulls and timber props used instead. As the length of the ore-shoots is never great, 50 to 100 ft. being the maximum, the practice of leaving no pillars involves no danger, unless of course the ground is faulted. Shaft-ends are seldom seen, as they are not considered necessary, owing to the ore-shoot being short and the distance between levels small. The broken ore is carried to the shaft in wheelbarrows, except at the vertical shaft, when a track is laid and the bucket run to the working face on a car.

Sampling across the full width of the lode is done every day, and the gold content estimated by panning. Assay offices are practically unknown. As regards drainage, the water is led into a sump cut in the first level. Direct-acting duplex steam-pumps of the inside packed piston type are usually employed. Water accumulating below the first level is raised by hand-pumps or by small steam sinking-pumps. In shaft-sinking, vertical sinking-pumps, preferably of the outside packed type are used. Little sorting of the ore is done, only the large lumps of country rock being rejected while feeding the crusher. Native labour is cheap in Rhodesia. Hammer-boys are paid from 30 to 50s. per month, and shovellers, trammers, and surface workers 20 to 30s. The highest native wage is £3 per month, and is paid to shift-bosses, boiler attendants, and police. The number of natives required for a mine using a 2-stamp mill and having a 3 ft. stopping width is from 80 to 100. For a mine with a 5-stamp mill the number is 150. As regards white labour, this is seldom practicable, as the rates demanded are too high. Usually the tributing is done by two or three partners, who share the responsibility of management in all departments. Working expenses on the basis of 2 stamps, crushing 250 tons per month, with 75 ft. of development work, and ordinary pumping duty, average as follows per ton: Stopping 5s. 10d., development 4s. 10d., hoisting 2s. 10d., pumping 1s. 7d., milling 3s. 6d., cyaniding 2s. 6d., sundries 10d., total 21s. 11d. No wage for white workers is included in this total, as partnership is presumed.

Most of these small mines use the cyanide process as well as amalgamation. The sand only is treated, and the slime is generally lost. Pits are used instead of the usual collecting tank. The treatment-vats are made of galvanized iron, lap-jointed and double-riveted, while the rim is strengthened by angle-iron. They rest on the ground, and are packed round with sand. The dimensions average 16 ft. diameter by 5 ft. deep. The extractor-boxes are made of sheet-iron, and have six compartments each of 2 cu. ft. capacity. The sand to be treated is shovelled from the collecting pits to the treatment vat by natives, two emptying the pit and two filling the vat. When treating current sand, no preliminary wash is given. A solution containing 0.2 to 0.25% KCy is pumped in and allowed to remain for 12 to 24 hours. After the removal of this solution, other solutions weaker in cyanide are used, down to 0.1% KCy, and finally a water wash is passed through. The strength of the final cyanide solution, 1% KCy, is kept high in order to minimize the formation of white precipitate in the extractor-boxes. While the consumption of lime and cyanide varies on different mines, the figures may be taken at 2 lb. lime and 0.8 lb. cyanide per ton. The solutions are run through one extractor-box only, which is dressed fortnightly. The clean-up is done fortnightly or monthly. The author concludes by describing the conditions of prospecting

in Rhodesia, and shows that most of the ancient workings have been fully exploited. The only hope for the prospector nowadays is the hitherto undiscovered lodes.

The Hendryx Agitator.—The *South African Mining Journal* for July 27 publishes the report of the Mines Trials Committee on the Hendryx agitator. This machine is intended for the treatment by cyanide of sand and slime or of the pulp from the tube-mills without classification. It consists of a cylindrical body with the usual conical bottom, and the pulp is forced up the central tube by the rapid revolution of screw-blades. This mechanical circulation is more effective than the air-lift or the method of circulation of decanted solution by means of a centrifugal pump, for by its use the gold is brought into solution within a few hours, and a short stoppage of the plant does not cause a hopeless clogging of solids at the bottom. The disadvantages are that more power per hour is consumed than by some other processes, but the less total time required must be taken into consideration when figuring the total power.

The report published by the Mines Trials Committee gives details of the results of five tests on mill tailings containing from $1\frac{3}{4}$ to $2\frac{3}{4}$ dwt. gold per ton. The average time of treatment was 6 hours and the extraction varied from 85 $\frac{1}{2}$ to 95% of the estimated gold content from residues after amalgamation. The pulp contained about 40% of plus 120-mesh and 60% of minus 120-mesh. In one test, only slime was treated, and in 2 hours 92% of the estimated gold content was extracted.

CURRENT LITERATURE.

Rapid Tunneling.—In the *Engineering and Mining Journal* for August 17, Norman F. Carmichael describes the driving of the new haulage adit at the mines of the Arizona Copper company.

Campaign against Flies.—The *South African Mining Journal* for July 27 reprints the recommendations issued by the Rand Mines Limited in 1910, detailing the methods to be adopted for minimizing the spread of infection by flies.

Stripping Gravel Deposits.—In the *Mining and Scientific Press* for August 3, Francis J. Dennis discusses the various machines and methods for removing overburden from auriferous gravel and similar deposits.

Flotation.—*Gluckauf* for July 27 and August 3 contains an article by L. Herwegen reviewing the various flotation processes.

Copper Determination.—In the *Engineering and Mining Journal* for August 17, F. H. Probert describes the electrolytic apparatus, with revolving anodes, used for determining copper in the laboratories of the Ray and Miami mines.

Vanadium.—*Metallurgical and Chemical Engineering* for August contains an article by Siegfried Fischer describing the extraction of vanadium from carnotite and vanadiferous sandstone such as are found in Colorado.

Drying Air for Blast-Furnaces.—*Metallurgical and Chemical Engineering* reprints a paper read before the Engineers' Society of Western Pennsylvania by Bruce Walter, describing in full the Gayley plant for removing moisture from the air used in blast-furnaces.

Estimation of Tungsten.—The *Mining and Engineering World* (Chicago) for July 13 contains a note by E. H. Quinney describing a method of estimating tungsten in ore devised by B. M. Divani in connection with wolfram deposits in the Black Hills, Dakota.

Estimation of Sodium Peroxide.—In the *Mining*

and *Scientific Press* for July 20, H. L. Easton describes a method of estimating sodium peroxide, being a modification, devised by J. P. Walker and the author, of that given in Sutton's 'Volumetric Analysis.'

Cobalt.—In the *Mining and Scientific Press* for July 20, Reginald E. Hore reviews the progress at Cobalt, Ontario, noting chiefly the geological points of interest recently revealed in the workings.

Lead-Silver Ores of Wardner, Idaho.—In the *Mining and Scientific Press* for August 3, F. L. Ransome criticizes O. H. Hershey's theories as to the genesis of the lead-silver ores of Wardner, Idaho, published in the issues of June 1, 8, and 15.

Miami Copper Deposit.—In the *Mining and Scientific Press* for August 3, M. H. Loveman discusses the geology and genesis of the Miami orebody, Arizona, in the light of the most recent developments.

Dry Placers in Arizona.—In the *Mining and Scientific Press* for August 10, T. Lane Carter describes gold placers in Arizona where there is no supply of water for their beneficiation; the article is of interest in connection with F. J. H. Merrill's contribution on the working of dry placers, a précis of which appeared in our last issue.

BOOKS REVIEWED

THE GEOLOGY OF THE MURCHISON RANGE AND DISTRICT. By A. L. Hall. Octavo, paper covers. 190 pages, with maps and illustrations. Pretoria: The Government Printing and Stationery Office. Price 7s. 6d. For sale by *The Mining Magazine*.

This memoir, published by the Mines Department of the Union of South Africa, has appeared at an opportune moment, as the construction of the Selati railway connecting Delagoa Bay with Leydsdorp and the Pretoria-Bulawayo railway system has once more stimulated interest in a mining district that has hitherto been handicapped by lack of communications. The ancient copper workings at Palabora are in this region; we quoted in a previous issue T. G. Trevor's article on the subject. Many gold mines containing antimony and arsenic are awaiting development, and mica deposits promise to prove of commercial value. Mr. Hall's treatise gives a large amount of geological and other information that will prove of great help to those interested in the district.

A TEXT-BOOK OF RAND METALLURGICAL PRACTICE. VOLUME II. By W. A. Caldecott, C. O. Schmitt, and others. Cloth, octavo, 440 pages, with many illustrations. London: Charles Griffin & Co. Price 21s. For sale by *The Mining Magazine*.

In our April issue we referred at some length to the first volume of this important work, and mentioned that the object of the book was to present an epitome of Rand metallurgical practice, each department of the subject being treated by men having special experience in their particular lines. The second volume has now been published. It is devoted entirely to a study of the plant employed and is written from the mechanical engineer's point of view. C. O. Schmitt is responsible for the whole of the volume. After a preliminary chapter, the author proceeds in Chapter II to describe the screening, sorting, and breaking plant, and in Chapter III the stamp-mill and the tube-mill. The construction of all these machines is described in detail, and dimensioned drawings are given. The costs of construction and operation are discussed, and the various policies compared from an economic standpoint. The design of the mill buildings and the general arrangement of the plant add greatly to the value of the book. These chapters occupy nearly one-half of

the volume. Chapter IV describes the amalgamation plates, for battery and tube-mill, shaking and stationary, and Chapter V deals with the clean-up. Nearly 100 pages are devoted to the cyanide plant, including classifiers, distributors, sand-filters, slime-filters, leaching vats, clean-up plant, etc. An important chapter of 50 pages is devoted to the details of estimating, and a following one discusses the cost of plant. The remaining part of the book is devoted to the transport of ore and other materials, endless ropeways, conveyer-belts, pumps, elevating wheels, air-lifts, excavators for discharging vats, tailing disposal, etc. The illustrations are an important feature of the book. The photographs are always helpful, and the multitude (over 400) of line drawings are invaluable. E. W.

AN INTRODUCTION TO BRITISH CLAYS, SHALES, AND SANDS. By Alfred B. Searle. Cloth, octavo, 460 pages, with many illustrations. London: Charles Griffin & Co. Price 7s. 6d. For sale by *The Mining Magazine*.

The average mining engineer knows little or nothing about clays, as this branch of the mineral kingdom receives but scant notice in his course of study, being as much neglected in the usual mining course as silicates in the chemical lectures. Yet clay is of great importance to the mining engineer and metallurgist. How many smelting campaigns have proved disastrous owing to the ignorance, on the part of the manager, of the nature and properties of the aluminates and silicates? Then the possession of a suitable fire-brick is one of the essentials of fire metallurgy, and in zinc distilling the clay of the retort is of the utmost importance. The preparation of a suitable mixture of clay and carbonate of lime is the foundation of the cement industry. Oil shale and alum shale form the basis of important industries, and china-clay is not only the most important mineral produced in Cornwall (not even tin outshining it) but its origin provides the mineralogist with a most interesting subject for discussion and speculation. We are so often asked for literature giving scientific accounts of this group of minerals that we are glad to receive Mr. Searle's book and to recommend it to our friends.

The first two chapters discuss the formation of clays from igneous rocks, and the next three the sedimentary rocks and their clay-forming constituents. Chapter VI describes the chief characteristics of various clays and shales, Chapter VII minerals similar to clay, and Chapter VIII the minerals and other constituents usually associated with clay. The next chapters deal with the physical and chemical properties, the methods of prospecting, mining, and quarrying, and the purification and preparation of clays. We may add that the study of clays has been of considerable importance in general chemistry from the point of view of the colloidal form of existence of many substances.

E. W.

THE CLAY-WORKERS' HAND-BOOK. By Alfred B. Searle. Cloth, octavo, 420 pages, illustrated. London: Charles Griffin & Co. Price 6s. For sale by *The Mining Magazine*.

It is opportune, while reviewing Mr. Searle's new book on 'British Clays,' to mention the appearance of a second edition of his 'Clay-Workers' Hand-Book.' The first edition proved highly acceptable to those desirous of details as to the preparation of clays for their various uses. A large portion of the book relates to the manufacture of pottery, and is therefore of help to those interested in the requirements of the trade in connection with china-clay. The new edition contains much new matter.

MICA: ITS OCCURRENCE, EXPLOITATION, AND USES.

By Hugh S. de Schmid. Paper covers, 420 pages, with many maps and illustrations. Ottawa: Government Printing Bureau. Price 8s. 6d. For sale by *The Mining Magazine*.

We have frequently praised the technological publications of the Canadian Department of Mines, produced under the general editorship of Eugene Haezel. Those on the non-metallic minerals, such as graphite, asbestos, and mica have been highly acceptable. The present book is called a second edition, the first having been written some years ago by Fritz Cirkel; but to all intents and purposes it may be regarded as an entirely new work. The conditions under which mica deposits in Canada are worked have greatly altered during the last few years, and many properties have been abandoned owing to the market depression. Most of the workings have been superficial, and the undependable nature of the pockets has deterred most people from doing expensive prospecting at depth.

Mr. de Schmid describes in detail the various Canadian deposits, and the methods of working. He also touches upon deposits in other countries, notably those of India, South Africa, and Brazil. Other chapters deal with the mineralogical and physical characteristics of mica, its geological associations, the methods of preparation for market, and its commercial uses.

THE TUNGSTEN MINING INDUSTRY IN NEW SOUTH WALES. By J. E. Carne. Paper boards, octavo, 105 pages, with maps and illustrations. Sydney: Department of Mines. Price 2s. 6d. For sale by *The Mining Magazine*.

We have on several occasions during the past two years referred to the development of the wolfram deposits in New South Wales, and have mentioned that the Broken Hill Block 14 Company has acquired one of these properties at Fielder's Hill. These deposits are found in the northeastern part of New South Wales, in the same district as the tin, which is the chief basis of the mineral industry in that part of the province.

NORTH-COUNTRY COAL AND SHIPPING ANNUAL FOR 1912. By Joseph Davies and Graham Wallis. Cloth, octavo, 240 pages, illustrated. London, Cardiff, and Newcastle-on-Tyne: The Business Statistics Company. Price 7s. 6d. For sale by *The Mining Magazine*.

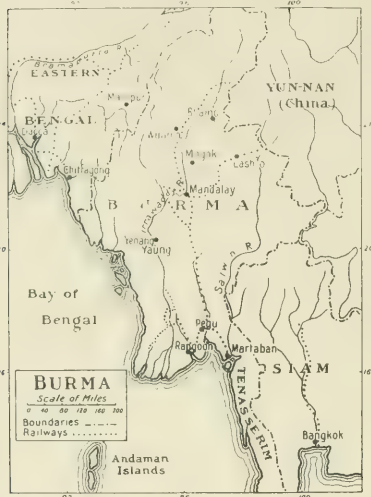
A few months ago we reviewed the 'South Wales Coal Annual,' issued by the same firm of publishers, and we are pleased now to receive a similar book giving details of the Northumberland and Durham collieries and coal trade. We hope a future edition will include a map showing the position of the collieries, so illuminating the official list reproduced by the authors.

THE MINING LAWS OF THE REPUBLIC OF COLOMBIA. Translated, with an Introduction and Notes, by Phanor J. Eder. Paper covers, 160 pages. Washington: Byron S. Adams. Price 8s. 6d. For sale by *The Mining Magazine*.

For many years there has been a demand for a translation of the laws of Colombia, and in all probability the proximity of the country to the new Panama trade route will increase the interest taken in America and England in mining in that part of the world. Twenty years ago Charles Bullman made a translation, but this has long been out of print; besides, the laws have been substantially altered since. The new book is published under the auspices of the Pan-American Union, and the author is a member of the New York bar.

COMPANY REPORTS

Burma Mines.—This company was formed by Bewick, Moreing & Co. in 1906 for the purpose of acquiring ancient silver-lead mines and slag heaps at Bawdwin, near Lashio, in Upper Burma, not far from the frontier of China. The mines had been worked previously by the Chinese for the silver content of the ore, and the lead was an unconsidered item, to judge by the fact that the slag averages 45% lead. These workers confined their attention to the oxidized zone, and the sulphides disclosed by the development work done by the present company contain a large proportion of zinc. Two years ago we recorded that the expectations on flotation had been by no means realized, and that the company had had to be reconstituted on a new basis by drastically reducing the nominal capital, and at the same time assessing the shareholders. The issued capital now consists of 312,046 shares of 4s.



each, on which £33,737 has been called up, and there are also £213,685 debentures. The report for the year 1911 just issued shows that the affairs of the company are still being rearranged with the object of putting it on a sounder basis. The smelter has been removed from Mandalay to the vicinity of the property in order to save the expense of transport; a refinery is being built so as to extract the silver and sell the lead in the Eastern markets; while the prospecting and development work has been actively prosecuted so as to give the company a source of ore instead of being dependent too much on the old slag heaps. The ore disclosed in these developments consists of mixed sulphides, running high in lead and zinc, with some iron and copper, and containing much silver. The ore varies greatly in content, but taking an average of the samples quoted in the report, it may be said to contain 8 to 20% lead, 10 to 33% zinc, 1 to 10% iron, 0 to 5% copper and 5 to 25 oz. silver per ton. The gangue is mostly quartz. In view of the

changed conditions due to the nature of the sulphide, large parcels of the ore have been sent to London for the purpose of determining the best method of treatment. During the year under review, the smelting plant at Mandalay treated 34,340 tons of slag averaging 45% lead and 2.62 oz. silver, also 2589 tons of Bawdwin ore, and 816 tons of purchased ore. After the removal of the smelter to the mine, 1019 tons of slag and 600 tons of ore was smelted. The total bullion produced amounted to 13,756 tons. The receipts from its sale were £181,296, and the cost of mining, smelting, and administration was £148,804. Out of this £5658 was allowed for depreciation, and £12,821 was paid as debenture interest. The net profit was £15,126, which was carried forward.

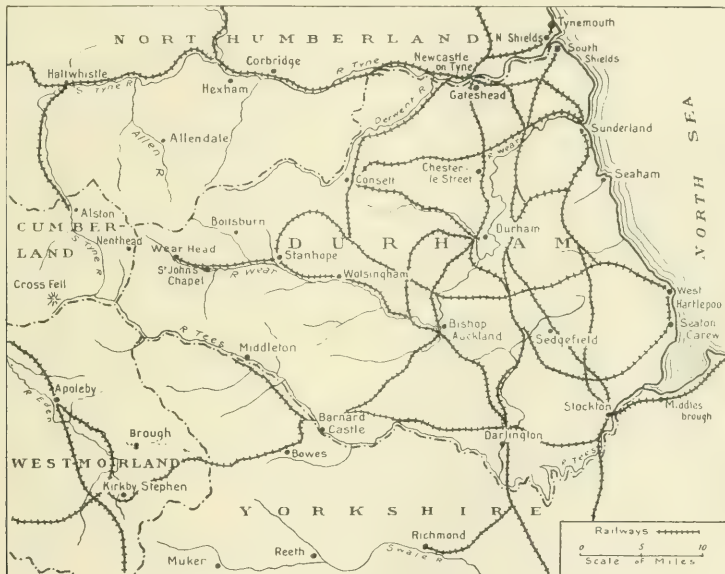
Burma Ruby Mines.—It is pleasant to record that this company is once more on the list of dividend payers. It was floated 23 years ago by the Rothschilds to consolidate the ruby and sapphire mines at Mogok, Burma. The expectations of big profits were never realized, and not only have the dividends been small, but the capital has been reduced. Much larger amounts of money were required in order to bring the cost to a practicable level, and moreover the terms and conditions imposed by the Indian government have been decidedly oppressive. During recent years the market for this class of stone has diminished, the diamond carrying all before it. The sapphire is not popular, as it is ineffective at night, and to the uninform the best quality of garnet seems as satisfactory as the ruby. Moreover the artificial ruby and sapphire, manufactured by the method described in our issue of June of last year, have made inroads into the trade in the genuine article, and have penetrated even to the East. The report of the company for the year ended February 29 shows that the amount of gravel washed has been maintained, 1,479,845 loads being treated at a cost of 7½d. per load, as compared with 1,466,136 loads the previous year. The sales in London were £10,236, and in Burma £48,551. In addition £12,069 was received from tributaries. The sum of £10,862 was paid to the Indian government as royalty, and also £2378 as share of the profits. The profit available for shareholders was £5256 and, adding £16,764 brought forward from the previous year, the disposable balance was £22,021. Out of this £7475 has been paid as dividend, being at the rate of 2½%. The company has recently received a favour from the government in connection with the item of £19,228 of arrears of royalty and rent. The payment of this sum is postponed until the net profits available for shareholders exceed 10% on the capital in any one year; in this case half the surplus is to be employed toward liquidating the debt. This lenient attitude was assumed by the government because the company intimated a desire to develop additional ground at Kathie, six miles from Mogok. This work has now been commenced, and is estimated to cost £20,000.

Central Zinc.—This company was formed in 1906 as a subsidiary of the Sulphide Corporation, for the purpose of erecting a zinc-distilling plant at Seaton Carew, in Durham county, north of England, where concentrate from the Central mine at Broken Hill was to be treated. The capacity of the works was to be 40,000 tons of concentrate per annum, and the contract for the supply lasts for 10 years from 1907. The capital is £150,000, and all the shares were subscribed in cash by shareholders in the Sulphide Corporation. J. C. Moulden is manager. Owing partly to not-unexpected metallurgical troubles, but more so to the difficulty of collecting and training a suitable staff of workmen at Seaton Carew, the progress has been slow.

The report for the year ended March 31 shows that six furnaces are now in operation, and that during the year 8413 tons of concentrate was treated yielding 2658 tons of zinc, 40 tons of blue powder, 42.7 tons of metallic lead, and 5239.5 tons of argentiferous leady residues. Though this output is a long way below the original estimates and intentions, it marks a substantial increase over preceding years, in spite of temporary suspension of operations owing to the coal strike. As soon as the necessary complement of workmen can be collected, the seventh and eighth furnaces are to be erected, and the ninth and tenth will be built later. Additional mechanical mixers are being provided, and also concentrators for the treatment of the leady residues. The profit for the year was £6812, of which £3195 goes to the Sulphide Corporation.

come of £40,762, of lead ore £598, and of fluor-spar £6211, and there were other small items of revenue. The total expenses were £39,378 and the divisible profit £10,340. The sum of £9791. 18s. has been distributed as dividend, being at the rate of 10%. The drought of last summer greatly interfered with operations, and both the concentrating plant and the smelter were idle for two months in consequence of the lack of water. Improvements in smelting operations are being made; a roasting furnace has been installed, and a water-jacket blast-furnace is being substituted for the old hearth. The developments at the Boltsburn mine are highly encouraging, and large amounts of high-grade ore have recently been discovered.

Mount Morgan.—This celebrated gold and copper producing company has been passing through a critical



THE LEAD MINING DISTRICT OF THE NORTH OF ENGLAND.

Weardale Lead.—This company has been working a group of lead mines in Durham county, in the north of England, since 1883. The shareholders are largely residents in Newcastle-on-Tyne and adjoining districts. The mines are situated in the high country of the Pennine chain near the boundaries of Northumberland, Durham, and Cumberland. The Alston and Nenthead lead and zinc mines are not far away. The galena is found in the Carboniferous limestone. The chief producer is the Boltsburn mine. Henry Louis is technical adviser and H. S. Willis is manager. The report for the year ended June 30 shows that 3778 tons of lead concentrate was produced, and 3724 tons smelted, yielding 2643 tons of pig lead, which sold for £15. 8s. 5d. per ton. In addition to lead ore, 16,000 tons of fluor-spar was raised, chiefly from the Stanhopeburn and Sedling mines. The sale of lead brought an in-

period during the last twelve months, but owing to the fact that the bulk of the shares are held in large blocks by Australian owners little has been heard of the crisis here, and not much in Australia. The trouble apparently began when the smelting of the auriferous copper ore was inaugurated, but it became acute when the pyritic ore from Many Peaks was substituted for the barren ironstone flux previously brought from Iron Island. The services of A. L. Dean, of the Mount Lyell mine, were requisitioned, and Robert S. Sticht has also been on the spot. The smelting plant has been reorganized and the celebrated 'mundic works,' where the pyritic gold-quartz has been chlorinated for years, is to be abolished. It has never been known outside the works whether this chlorination process was an economic success or not, for no figures relating to the original content or percentage extraction have

been published. Two years ago the gold ore of the oxidized and leached zone was exhausted, so in future the mine is to be treated solely as a smelting proposition. A great deal has been said from time to time about the high costs at this mine. For instance, during the last financial year the yield of gold and copper was worth 53s. 3d. per ton of ore, and the cost 44s. 5d. With the new management it is hoped to vastly increase the margin between these two figures. We are now informed that G. A. Richard has resigned as general manager, and that Robert S. Archer, previously chairman of the board, has been appointed managing director. The report for the year ended May 31 last touches very lightly on the troubles through which the company has passed. It shows that 93,413 tons of ore was treated by chlorination, yielding 51,202 oz. gold, or 10.96 dwt. per ton, and 852 tons copper. The smelters treated 166,499 tons of Mount Morgan ore yielding 4520 tons copper and 82,655 oz. gold, and 91,946 tons of Many Peaks ore yielding 2068 tons copper and 718 oz. gold. The total production was therefore 7440 tons copper and 134,575 oz. gold. The ore reserve has been re-estimated, with the remarkable result that the gold content is now given at a substantially higher level. The figures on May 31 last were: 1,499,000 tons averaging $3\frac{1}{2}\%$ copper and 10 dwt. gold, and 2,027,000 tons averaging $2\frac{1}{2}\%$ copper and 5 dwt. gold per ton. A year previously the figures were: 1,543,000 tons averaging $3\frac{1}{2}\%$ copper and 8 dwt. gold, and 2,070,500 tons averaging 3% copper and $2\frac{1}{2}$ dwt. gold. During the year under review the revenue from the sale of gold and copper was £989,713. The cost of mining, extraction, freight and taxes was £731,715, and £24,706 was written off for depreciation. The sum of £200,000 was distributed as dividend, being at the rate of 20%.

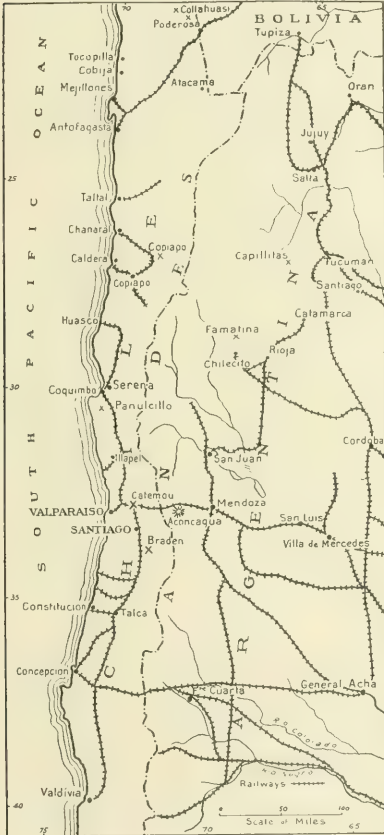
Otavi Mines & Railway.—This company was formed in Berlin in 1900 for the purpose of acquiring copper-lead mines at Otavi and Tsumeb, in German Southwest Africa, and to build a communicating railway from the coast to Swakopmund. The higher grade ore is shipped to Germany, and the remainder smelted on the spot, producing metallic lead and copper matte. During the year ended March 31 last, 38,200 tons of ore was raised, as compared with 42,000 tons the year before. Of this, 29,600 tons was prepared for export averaging 16% copper, 25% lead, and 9 oz. silver per ton; the remainder was smelted, yielding 991 tons of 48% copper matte, and 913 tons lead containing 32 oz. silver per ton. The relative amount of ore exported was much greater than during the previous year, and the ore smelted on the spot correspondingly smaller. The report shows that nothing but oxides and carbonates have been found so far, though the main shaft is down 340 ft. Between the 3rd and 4th levels the ground is much broken, and extra prospecting and development work has had to be done. The east orebody has been proved on the fourth level to be 15 to 22 ft. thick and 125 ft. long, and to contain ore of average grade. The west orebody on this level is more irregular and smaller than on the levels above. Diamond-drilling has been done to a depth of 75 ft. below the fourth level on the east orebody, in good quality ore all the way. Prospecting at other properties in the Otavi valley has not so far yielded satisfactory results, as the ore discovered is pocket. The receipts from the sale of ore, etc., during the year under review were 6,497,216 marks; 1,300,770 marks was spent on mining, 617,567 marks on smelting, and 1,962,873 marks on shipping and freight. In the railway department the receipts were 4,863,141 marks, and the working expenses 2,196,446 marks; in addition 574,866

marks was paid as railway rental to the German government, and 412,203 marks was placed to the railway renewal fund. The sum of 867,007 marks was allowed for depreciation, chiefly at the mines; 304,335 marks was paid for administration, and 469,945 marks as interest on debentures. The net profit was 2,683,767 marks, out of which 200,000 marks has been placed to reserve, 1,200,000 marks distributed as dividend on the ordinary shares, being at the rate of 30%, and 1,000,000 has been paid on the *genusschein*, that is to say, the deferred shares.

Pigg's Peak.—This company was formed in London in 1889 for the purpose of acquiring a gold-mining concession in Swaziland, previously worked by a company registered in South Africa. The control is with the Ehrlich group, and E. T. McCarthy, who was originally general manager, is now consulting engineer. The present manager is Charles Hunter, who succeeded D. V. Burnett a few months ago. A 20-stamp mill was erected at the Pigg's Peak mine, but operations were suspended at the commencement of the war, and were not resumed until 1908. The report for the year ended March 31 shows that 31,913 tons of ore averaging 8½ dwt. was mined and sent to the mill. Of this, 1660 tons came from the New Section mine, where an additional 5-stamp mill and a concentrator have been erected; the ore is of a refractory nature and the concentrate produced is shipped to England for sale. The income was £52,358 derived from the sale of 12,375 oz. gold, and £1931 from the sale of concentrate. The total expenses, including administration, taxes, and debenture interest, were £32,562, and the profit was £21,728. The sum of £21,899 has been written off for mine development, so that the net profit is nothing. The company also owns the Eagle's Nest property near Barberton in the Transvaal, where recent developments have disclosed additional amounts of ore averaging from 6 to 7 dwt. gold per ton; the beneficiation of the ore is still postponed until a suitable method of treatment has been devised. The Ruby Creek property adjoining the Pigg's Peak has recently been acquired, and prospecting has commenced, but the outcrops of the lodes so far discovered do not carry profitable amounts of gold, though the content appears to be increasing with depth.

Mond Nickel.—This company owns copper-nickel mines at Sudbury, Ontario, and a refining plant for the matte at Swansea; it produces metallic nickel and copper sulphate, and uses the Mond separating process. The report for the year ended April 30 shows that its prosperity has still further increased. The net profit was £154,364, out of which £7718 has been paid as directors' remuneration, £26,666 as 7% preference dividend, £45,906 as ordinary dividend at the rate of 16½%, and £26,131 as dividend on deferred shares; £35,000 has been placed to various reserve funds, and £41,381 carried forward. The dividends are the same as the year before, but the amounts placed to reserve and carried forward are greater. During the year, £250,000 5% debentures have been issued for the purpose of completing the new smelting works at Coniston, Ontario, and for extending the works at Swansea. The chairman, in addressing the shareholders, stated that the demand for nickel expands steadily. He expressed the hope that the British Government would eventually adopt a coinage containing nickel, as a substitute for the present cumbersome coppers. The Government makes nickel coins for use in the Crown Colonies, and supposedly backward countries like India, China, and Central Africa already have such a coinage, while the nickel coins of America and Europe are well known.

Central Chile Copper.—This company was formed in 1894 to continue the work of the Panulcillo Copper Co., which originally started operations in 1864. The issued capital is £312,468, and small dividends have been paid in 1896, 1900, 1901, and 1907. The old Panulcillo company paid dividends during three short runs of years, but on the whole was not a profitable proposition. A large proportion of the shares of the



Copper Mines in Chile and Argentina.

present company are held in France. Eugene A. J. Goldschmid is chairman, B. C. Hinman is managing director, and H. M. McLaughlin is manager in Chile. The report now issued covers the year 1911, and shows that 19,253 tons of the company's ore averaging 3½% copper, and 16,664 tons of purchased ore averaging 7½% copper was smelted during the year, yielding matte containing 1708 tons copper. The low price of copper restricted the amount of ore available for pur-

chase, as was the case during the two preceding years. The advance in the price since the end of the year has induced many owners to reopen their mines, so that the outlook as regards the supply of custom ore is now much brighter. It is also noteworthy that during 1911 the developments at the company's mines have disclosed a larger amount of ore and of higher grade. The accounts for 1911 show an income of £88,314 from the sale of copper, and £6499 from the precious metal contents. The expenditure includes £21,287 cost of mining, £26,757 smelting, £18,224 freight and refiners' charges, and £35,215 cost of custom ore. The administration expenses amounted to £3161, and £1317 was allowed for depreciation. The profit and loss account for the year shows a loss of £2200, which added to the debit carried forward from the previous year makes an adverse balance of £10,154. The increased price of copper may restore the fortunes of this company.

Arizona Copper.—This company, with headquarters in Edinburgh, owns the Longfellow and Metcalf groups of copper mines, a smelter at Clifton, Arizona, and a railway serving the district. The half-yearly interim report for the six months ended March 31 shows a production equal to 9073 short tons of bessemer copper. The profit from the mine was £150,596, and £36,351 was received from the railway. Out of this £2733 has been paid as interest on debentures, £7767 as income tax, and £12,265 as dividend on the preference shares. The ordinary shares receive £94,993, being at the rate of 25% on 1,519,896 shares of 5s. each, and £69,187 is carried forward. As we have already recorded, £500,000 new debentures were issued three months ago for the purpose of raising the capital required for increasing the output, extending the dressing plant, and rebuilding the smelter, according to the design and recommendations of L. D. Ricketts. The report shows that these improvements are in hand.

New Gopeng.—This company was formed in 1903 to acquire alluvial tin properties at Gopeng, Perak, Malay Peninsula. It belongs to the group of Malay tin mines controlled by James Wickett, of Redruth, and managed by Osborne and Chappel. Production and dividends have been continuous from 1904. In addition to tin, the company pays attention to rubber planting, and makes an additional income thereby. The report for the year ended April 30 last shows a production of 101½ tons of tin concentrate, which sold for £11,348. The cost at the mines was £4839, and taxes and administration brought the total expenses to £5645. The rubber industry yielded a profit of £3864, and interest, etc., brought the total receipts to £15,298, leaving a divisible profit of £9653. The sum of £4818 was brought forward from the previous year, making the total disposable balance £14,472. Out of this, dividends amounting to £10,000 have been paid, being at the rate of 25%. The directors announce a scheme for the amalgamation of the company with the Gopeng, particulars of which are given in the next paragraph.

Gopeng Tin.—The directors of this company, which belongs to the group of Malay tin mines controlled by James Wickett, of Redruth, have issued a circular recommending the amalgamation of the Gopeng with the New Gopeng. It is announced that Osborne & Chappel, the company's managers, have secured from the Government an important water-right, permitting them to take 6000 cu. ft. of water per minute from the Ulu Kampar river, to be used at the mines managed by them in the Gopeng district. The activities of Osborne & Chappel are not confined to the Gopeng and New Gopeng properties; they are also managers for the

Kinta company in the same district. It has been arranged that the water shall be brought from the river in one pipe-line, and distributed on the spot in equal portions to the three companies. Under these altered conditions and for the purpose of raising further working capital, it is deemed best to amalgamate the Gopeng and New Gopeng. A company is to be formed called the Gopeng Consolidated, with a capital of £400,000, of which £190,000 in fully paid shares is to be allotted to the Gopeng, and £60,000 in fully paid shares to the New Gopeng. The remaining 125,000 shares are to be offered for subscription in order to provide the required funds for developing the new system of working.

Rambutan.—This company was formed in 1905 to acquire alluvial tin properties at Tanjong, Perak, Malay Peninsula. It was promoted by James Wickett, of Redruth, and Osborne & Chappel are the managers. Operations have been conducted so far by means of a dredge, but with indifferent results. The managers have recently obtained from the Government a concession enabling them to take 2000 cu. ft. of water per minute from the Kinta river, and it is proposed therefore to change the method of working to hydraulic mining. The cost of the new work is estimated at £46,750. The capital of the company is to be increased from £27,000 to £100,000. Of the new shares 3000 are to be paid to Osborne and Chappel and 10,000 to the directors, and out of the cash subscribed, the loan of £15,000 from the bankers, secured by debentures, is to be repaid. The managers estimate that in future it will be possible to treat 600,000 cu. yd. per year at a profit of £23,100. The gravel has been proved by borings to contain 1.6 lb. black tin per cu. yd.

Nigerian Tin Corporation.—This company was formed at the end of 1909 by a London group connected with Dolcoath for the purpose of prospecting in Northern Nigeria. At the time of flotation no particular property was in view. The report for the year ended March 31 shows that of five properties acquired by lease on the Bauchi plateau, three have been sufficiently proved to warrant the commencement of sluicing operations. From these properties, 93 tons of tin concentrate was recovered by calabashing during the year. The corporation has also acquired the sole prospecting rights over 32 square miles in the Ninkada district farther south. The proceeds from the sale of tin do not figure in the profit and loss account, but are credited against mining expenditure in the balance-sheet. The profit and loss account shows that a profit of £27,017 was made by the purchase and sale of shares in other companies, and a net balance of profit of £26,081. Out of this, £13,985 is being paid as dividend, at the rate of 25%, on the paid-up capital. Since the close of the company's financial year, the capital has been increased by the issue of 29,567 additional shares realizing £62,759. The issued capital now stands at 79,567 shares of £1 par value.

Standard Consolidated Tin.—This company was formed in England in February, 1911, to acquire a lode-tin property 60 miles north-west of Charters Towers, Queensland, and it belongs to the same group as British Broken Hill and Cornwall Tailings. The issued capital is £31,030, of which £11,030 was subscribed in cash. The report now issued covers the period from the inauguration of the company to April 30 last. It shows that developments at Daintree's and the Lucky Hit workings have given satisfactory results, and that in some places rich ore-shoots have been found. At one place the shoot is 6 ft. wide, and averages 15% black tin over 3 ft., and at another the level is in 5% ore 18 in. wide for 120 ft. There are large bodies of 2 and 3% ore. A 5-stamp mill was started in February and has

been treating ore containing 4.7% black tin. The results obtained by this mill and in the mines are sufficiently good to warrant the expenditure of further capital on developments and dressing plant. It is proposed to erect a 20-stamp mill when the necessary funds have been raised.

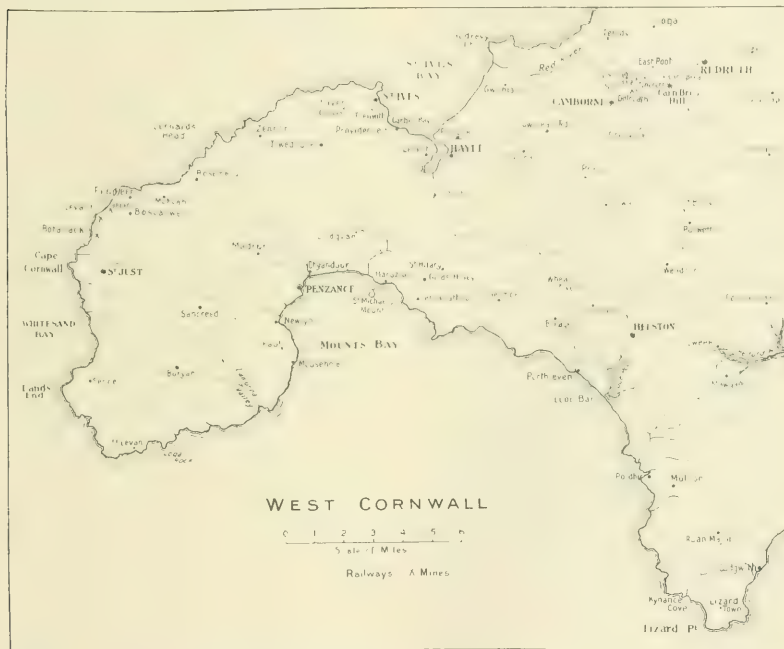
Dolcoath.—The report of the Dolcoath tin mine, Camborne, Cornwall, for the first six months of 1912 shows that as compared with the second half of 1911 the amount of ore raised was 2223 tons greater, the yield of black tin per ton $4\frac{1}{2}$ lb. less, and the average price received £7 2s. 1d. per ton more. The sales of tin concentrate realized £97,730 as compared with £98,647, and the profit was £32,538 as compared with £35,581, so that the varying factors fairly well equalized the results. The tonnage crushed was 48,566, the black tin sold 796 tons, the yield per ton 36 73 lb., worth 40s. 2d., the average price per ton being £122 14s. 7d. Other items of revenue brought the total income to £100,428 or 41s. 4d. per ton. The working cost was £61,375 or 25s. 3d. per ton, and the lords' royalties £6515 or 2s. 8d. per ton, making a total cost per ton of 27s. 11d. The profit, as already recorded, was £32,538 or 13s. 5d. per ton. Out of the profit £4594 has been written off on plant, houses, etc., and £17,225 was paid as dividend, being at the rate of 15% per annum. During the half-year, four more pneumatic or 'air-cushion' stamps have been erected, thus completing the new installation of twelve stamps. During the current half-year the output of the mill will be thereby increased. In the early part of 1912 the floods interfered with the working of the lower levels, and made it impossible to increase the output to the capacity of the enlarged mill. For several months the old Cornish pumping-plant was used in conjunction with the new electrical plant. Since the beginning of June the latter has handled all the water by itself and has given every satisfaction. The coal strike was responsible for a curtailment of development work, 1881 ft. being done, as compared with 2076 ft. during the previous half year. A new compressor is being erected at the Williams shaft, and when it is completed it will be possible to increase the amount of development done. As has been recorded in our pages already, the ore disclosed during the last year or so has not been up to the average of recent years. It is gratifying to find therefore from R. A. Thomas' report that richer ground, averaging 56 lb. black tin per ton, has been found on the 490-fm. level.

At the meeting of shareholders held on August 30, R. Arthur Thomas gave further details as to developments. He mentioned that in the drift on the 490-fm. level the last 72 ft. had been in ore averaging 100 lb. black tin per ton and he expressed himself as highly gratified at the improved prospects. He also announced that a further 4 stamps of the air-cushion type are to be erected.

Grenville United.—This company was formed in the summer of 1906 under the limited liability laws to acquire the Grenville tin mine situated to the south of Camborne, Cornwall, that had previously been worked for many years on the cost-book system. A year ago we mentioned that the new manager, Henry Battens, had introduced many reforms and improvements, both in the method of buying supplies and in the development and treatment of the ore. The report now issued covers the half-year January to June. During this time, 20,166 tons of ore was raised, and 369 tons of tin concentrate recovered, being a yield of 41 lb. black tin per ton. The figures for the previous half-year were 19,306 tons of ore, 331 tons of concentrate, and 38 lb. per ton. The concentrate was sold for £47,012, being at the

average rate of £127; this high price is obtained on account of the exceptional purity of the product. The profit was £17,295, out of which £3,501 was paid as lords' royalty, and £13,912 as dividend, being at the rate of 40% per annum. In May last a call was made of 2s. 6d. on the 49,730 shares of 10s. each, on which only 2s. 6d. had hitherto been paid. The capital now consists of 130,270 shares of 10s. fully paid, and 49,730 shares 5s. paid. During the half-year, development was retarded by the coal strike, but such work as was done gave gratifying results at many points, especially in the 355-fm level east of Fortescue's shaft. Mr. Battens gives details relating to the vigorous policy of development, and mentions that additional re-rolling and dressing plant is being provided.

£116, as compared with £69 for January to June 1909, when the record output of concentrate was made. The sale of wolfram and arsenic, together with other small items of revenue, brought the total income to £58,725. The working cost was £53,434, again a record figure, comparing with the previous highest, £47,504, during the preceding half-year, the rise being chiefly due to the greater amount of ore treated, but partly also to the greater cost of pumping and of new plant. The above figures include lords' royalties £2129. The total cost per ton was 23s. 6d., as compared with 22s. 9½d. during the previous half-year. The net profit was £7321, and, deducting the adverse balance, £6017, brought forward from the previous half-year, the credit balance on June 30 was £1102. E. S. King, the



Carn Brea & Tincroft.—The report of this Cornish tin-mining company for the half-year January to June shows that 45,444 tons of ore was raised, and that 482 tons of tin concentrate was recovered. The tonnage of ore was the largest on record, comparing with the previous highest, 41,674 tons, during the latter half of 1911. The output of concentrate is not so high as during the half-year January to June 1909, when 568 tons was obtained from 36,825 tons of ore. The yield per ton was 23'79 lb. black tin during the last half-year, figures not much different from the previous two half-years. On the other hand, the income from the sale of concentrate was easily a record at £56,096, owing to the present high price of the metal. The average price received per ton of concentrate was

manager. gives an outline of the developments during the period under review. Of these the most important is the cutting of Dunkin's lode on the 335-fm. level, as it promises to provide a large amount of good-quality ore. Also a new lode containing ore of more than average grade has been found in a cross-cut on the 160-fm. level in the Highburrow East section.

Robinson Deep.—This mine is a 'second deep' in the central part of the Rand, being on the dip of the Robinson Central Deep (now absorbed in the Crown Mines) and of the Ferreira Deep. It is controlled by the Consolidated Gold Fields and is isolated from others of that group, being entirely surrounded by Central Mining properties. C. D. Leslie is superintending

engineer and J. J. Wessels is manager. Milling commenced in 1898 with 40 stamps, and the equipment now consists of 300 stamps and 5 tube-mills; of the stamps only 210 are running at present. The report for the year ended March 31 shows that the output of ore has increased in spite of an insufficient supply of underground labour; this improvement is due to the extended use of small stopping-drills, 70% of the ore now broken in the stope-faces being obtained by this means. During the current year it is intended to entirely abolish hammer-boys. The amount of ore raised during the year was 698,521 tons, and after the rejection of 15% waste, 594,800 tons was sent to the stamps, as compared with 533,850 tons the year before. By amalgamation, 106,535 oz. was recovered below the stamps, and 52,905 oz. below the tube-mills; and by cyaniding the recovery was 47,651 oz. from sand and 19,092 oz. from slime, the total being 226,183 oz. worth £947,900, that is, 7.6 dwt. or 31s. 10d. per ton milled. The working cost was £523,380 or 17s. 7d. per ton, leaving a profit of £435,398 or 14s. 3d. per ton. Out of this, £34,359 was paid as profits tax, £55,827 placed to capital-expenditure account, and £28,998 paid to the Government in connection with undermining rights. The dividend absorbed £325,000, being at the rate of 32½%. The ore reserve on March 31 was estimated at 1,141,000 milling tons, averaging 7 dwt., and 83,000 tons of control developed estimated at 6.7 dwt. per ton. Owing to the improved position as regards output, it has been decided to employ an additional number of the stamps; with this object the tube-mill and cyanide department is being extended. The monthly capacity will thus be increased to 60,000 tons.

Mexico Mines of El Oro.—This company operating in the El Oro district of Mexico used to be in the control of the Exploration Company. It was formed in 1904 to acquire from the Mexican Gold & Silver Recovery Co. a group of gold-mining claims situated to the north of the Esperanza mine, which in its turn is to the north of the El Oro Mining & Railway Company's property. The same vein, the San Rafael, is found in the property of all the three companies. In 1910, the control passed from the Exploration Company, owing to the opposition of the Pearson and French groups of shareholders. Before the change of control, the Exploration Company had issued several gloomy reports prophesying a diminution of the grade of the ore and a reduction in the amount of ore raised. The yearly reports subsequently published have not so far confirmed these warnings, but have shown a maintained production and increased ore reserves. André P. Griffiths is consulting engineer and Fergus L. Allan is manager. The report for the year ended June 30 shows that 142,205 tons of ore was raised and sent to the mill, averaging 9 dwt. gold and 6 oz. silver. The bullion recovered was worth \$1,555,095 or \$10.89 per ton, being an extraction of 87.2%. The English accounts show an income from the sale of bullion of £317,329. The working cost in Mexico was £128,029 or \$4.37 per ton; other current expenses absorbed £46,300, £14,985 was spent on capital account, and £10,000 was placed to reserve for income-tax. The dividends absorbed £144,000, being at the rate of 80%. At the meeting of shareholders, the directors announced a further distribution of 10% for the year. On June 30, Mr. Allan reported the ore reserve at 395,100 tons assaying 9.14 dwt. gold and 5 oz. silver per ton. This is an increase of 76,000 tons as compared with the figures a year ago, and 110,000 tons more than at the end of June 1910. During the year a seventh tube-mill was added, and the drag-classifier has been adopted in place of the cones.

TRADE NOTES

Most of the trade publications mentioned in this column are available for distribution and the manager of The Mining Magazine will be pleased to secure copies for persons interested.

The General Electric Co. describe in leaflet C. 1559 a system of protection for electric cables underground.

The Wilfley Mining Machinery Co.'s Bulletin No. 67 announces the Hardinge Conical Mill in a four-page leaflet.

Boving & Co., Ltd., is the title under which the business of Jens Orten-Boving & Co. will now be conducted. The newly formed company has a capital of £30,000 preference and £30,000 ordinary shares.

W. F. Stanley & Co. condense their general scientific instrument catalogue and price list into a useful 360-page book which can be carried in the pocket; although small, the type is clear and well printed.

Bickford, Smith & Co. gave a series of interesting tests of their various types of fuse before a number of the members of the Scientific Societies in July. Their pamphlets on Volley-frirs and Instantaneous Fuse give many details not hitherto published.

The Colorado Iron Works Co.'s Catalogue No. 10 C. 'Advanced Cyanide Practice' gives a short history of the cyanide process and describes machinery built by this firm for cyanide equipment. The tables in the back are good and useful.

Chesters Renfrew Engineering Co. have sent us section No. 2 of their new catalogue, 'Ore Dressing Machinery.' We referred to sections No. 3 and No. 6 in our last issue. When complete this catalogue will form a useful reference book for any mine office.

Ad. Bleichert & Co. in sending us their latest printed announcements state "The number of plants which we have erected constitute more than one-half of all the ropeways actually built." This is a record of achievement and experience of which few manufacturers of essentially important machinery can boast.

The Hyatt Roller Bearing Co. are following up their excellent advertisements in the Technical Press of the United States by issuing a most artistic book intended to give information on their speciality. Over fifty views of various parts of their plant and offices are reproduced. Nothing short of an actual visit to and inspection of the works could give a better idea of the facilities and appliances utilized in turning out their roller bearings.

Hans Renold, Ltd., are the manufacturers of driving chains. 'Renold Block-Chains' is the title given to their April 1912 56-page catalogue which deals with the application of these chains for elevating and conveying purposes. Undoubtedly there are many instances where power can be transmitted with greater economy by chain-drive than by gears or short belts. It is a subject that those responsible for the design of mining and metallurgical machinery might investigate to advantage.

The Merrill Metallurgical Co.'s complete catalogue is a splendid example of trade literature. It gives information which could only emanate from a specialist. The detailed knowledge of cyanide practice shown in the explanatory reading matter should inspire confidence in the possible user and assurance that any orders placed with this company would have the supervision of men who know their business. The Merrill Zinc-Dust Precipitation Process is well known, and the newer processes are quite as useful and interesting.

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Scientia non habet inimicum nisi ignorantem.

T. A. RICKARD, Editor.

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C O N T E N T S.

	PAGE		PAGE
STATISTICS OF PRODUCTION.....	238	DISCUSSION	
REVIEW OF MINING.....	239	The Engineer in the Tropics.....	
EDITORIAL		..... Sir Alfred Keogh	289
Notes.....	245	Phantom Profits.....	
Rand Problems.....	248	.....H. S. Denny, Morton Webber	289
Mexican Affairs.....	250	Premature Precipitation.....A. W. Allen	294
Extraction Problems	251	Prospecting	Stephen J. Lett 294
Phantom Profits	252	Cornish Methods.....T. Henry Prisk	294
Thawing Frozen Ground	254	Efficiency	A. C. Schonberg 295
Debentures in Mining.....	256	Waihi Grand Junction.....P.G.M.	298
Journalism	257		
SPECIAL CORRESPONDENCE		PRÉCIS OF TECHNOLOGY	
Melbourne.....	259	Richards' Tin-Extraction Process	299
Johannesburg.....	261	High Grade, California	299
Kalgoorlie	264	Derdepoort Diamonds	300
Toronto	265	Genesis of Diamonds.....	300
San Francisco.....	267	Osmiridium in Tasmania.....	300
Mexico.....	269	Steel Sets in West African Mines.....	300
Camborne.....	270	Preventing Blasting-Fumes	302
New York.....	272	Nickel Coinage	302
METAL MARKETS	274	The Future Output of Gold	302
PERSONAL	278	Metallurgy of Aluminium	304
ARTICLES		CURRENT LITERATURE.....	304
Mine Valuation and Mine Finance....		BOOKS REVIEWED	305
..... H. C. Hoover	275	COMPANY REPORTS.....	308
The Murchison Range		TRADE NOTES	314
..... Alexander O. Brown	279		
Coalinga: A Californian Oilfield			
..... T. A. Rickard	283		

STATISTICS

STOCKS OF COPPER IN ENGLAND AND THE CONTINENT.
Reported by Henry R. Merton & Co. Tons of 2240 lb.

	July 31 Tons	Aug. 31. Tons	Sept. 30 Tons
In England	28,640	29,550	29,549
In France	7,476	7,856	7,584
Afloat from Chile	2,900	2,660	1,825
Afloat from Australia	6,000	5,660	5,250
In Rotterdam	750	570	450
In Hamburg	482	4,126	3,287
Total European visible supply	50,574	50,332	47,945

AMERICAN COPPER PRODUCERS' ASSOCIATION'S FIGURES.
In Tons of 2240 lb.

	Production.	Domes- tic	Deliveries Foreign	Total	Stocks at end of month
Total, 1911.....	639,258	316,791	337,009	653,800	39,937
January 1912.....	53,272	27,832	35,789	63,621	29,589
February	51,801	25,101	28,191	53,292	28,098
March	56,114	30,128	26,241	56,369	27,843
April	56,011	31,033	23,773	54,806	29,048
May	56,570	32,456	31,020	63,476	22,142
June	54,605	29,521	27,454	56,955	19,792
July	61,233	31,738	26,840	58,578	22,447
August	65,013	33,144	31,467	66,611	20,849
September	62,540	28,330	26,904	55,234	28,155

PRODUCTION OF GOLD IN THE TRANSVAAL.

	Rank	Else- where	Total	Value
	Oz.	Oz.	Oz.	£
July 1911	679,881	29,377	709,258	3,012,738
August	682,405	31,002	713,407	3,030,360
September	669,773	30,852	700,625	2,976,065
October	677,923	30,721	708,644	3,010,130
November	291,466	28,367	719,729	3,057,213
December	680,782	29,126	709,908	3,015,499

Totals, 1911..... 7,896,802 340,921 8,237,723 34,991,620

January 1912.....	709,280	27,750	737,030	3,130,830
February	674,960	28,906	703,866	2,989,832
March	*796,755	33,968	*830,723	3,528,688
April	706,763	30,897	737,660	3,133,383
May	746,948	33,714	780,662	3,311,794
June	722,588	31,348	753,936	3,202,517
July	735,941	30,397	766,338	3,255,198
August	722,197	32,540	754,737	3,248,395
September	716,495	31,398	747,893	3,176,846

* Including 70,143 oz. worth £297,946 extinguished reserve.

COST AND PROFIT ON THE RAND.

	Tons	Yield per ton	Costs per ton	Profit per ton	Total profit	
		s. d.	s. d.	s. d.	£	
1911.....	23,888,260	27	18	0	7	11,414,863
January 1912.....	2,067,161	27	6	18	0	997,557
February	1,980,396	28	19	2	0	907,192
March	2,163,998	28	1	18	11	1,204,764
April	2,059,562	28	6	19	0	1,005,920
May	2,177,348	28	6	18	9	1,073,534
June	2,110,657	28	5	18	6	1,063,634
July	2,144,788	28	6	18	8	1,061,089
August	2,141,133	28	9	18	10	1,055,315

NATIVES EMPLOYED IN THE TRANSVAAL MINES.

	Gold mines	Coal mines	Diamond mines	Total
January 31, 1912	184,046	7,805	9,524	201,375
February 29	190,330	7,922	10,789	209,301
March 31	196,748	8,195	12,071	217,017
April 30	197,937	8,364	13,785	220,086
May 31	193,829	8,460	14,538	216,827
June 30	188,494	8,549	15,530	212,573
July 30	182,625	8,497	15,541	206,663
August 31	179,111	8,766	15,934	203,811
September 30	180,739	8,783	15,752	205,274

GOLD OUTPUT OF INDIA.

	Year 1910	Year 1911	Sept. 1912	Year 1912
	£2,104,858	£2,150,050	£188,705	£1,681,383
PRODUCTION OF GOLD IN RHODESIA.				
MONTH.	1908	1909	1910	1912
	£	£	£	£
January	199,388	204,666	227,511	214,918
February	191,635	192,497	203,888	209,744
March	200,615	202,187	228,185	215,102
April	212,935	222,700	228,213	221,476
May	223,867	225,032	224,888	234,407
June	221,920	217,400	214,709	226,867
July	228,151	225,334	195,233	240,514
August	230,792	228,296	191,335	245,077
September	201,362	218,249	178,150	—
October	205,466	222,053	231,928	—
November	196,668	236,307	240,573	—
December	217,316	241,397	199,500	—
Totals.....	2,526,007	2,623,788	2,568,201	—

PRODUCTION OF GOLD IN WEST AFRICA.

MONTH.	1910		1911		1912	
	Oz.	Value	Oz.	Value	Oz.	Value
		£		£		£
January	17,357	70,699	15,903	66,107	26,098	107,262
February	16,976	68,469	15,179	63,081	25,009	102,270
March	17,637	71,954	16,187	67,673	27,228	111,376
April	16,363	67,069	17,237	70,880	27,790	114,796
May	16,590	68,355	24,427	96,409	28,015	115,678
June	17,194	70,988	22,555	92,174	27,784	114,697
July	15,564	58,551	22,510	91,955	30,974	127,800
August	13,921	57,713	25,185	103,753	33,015	136,407
September	11,497	47,746	26,717	109,039	—	—
October	13,341	55,046	26,825	109,303	—	—
November	14,021	57,658	24,289	99,299	—	—
December	15,042	61,737	24,369	99,569	—	—
TOTALS.....	185,493	755,985	261,784	1,069,442	—	—

PRODUCTION OF GOLD IN WESTERN AUSTRALIA.

	Export oz.	Mint oz.	Total oz.	Total value £
Total, 1910	363,496	1,209,856	1,573,352	6,682,402
Total, 1911	160,021	1,210,447	1,370,468	5,823,522
January 1912	10,697	95,673	106,370	451,828
February	10,441	92,091	102,532	435,526
March	408	92,547	93,005	395,058
April	10,698	94,708	105,406	468,972
May	9,288	98,104	107,392	456,170
June	1,214	106,930	108,144	459,605
July	8,892	96,838	105,730	418,738
August	7,767	101,377	109,143	461,466
September	1,580	109,525	111,105	472,170

OTHER AUSTRALASIAN GOLD PRODUCTION

	1910	1911	September 1912	1912
Queensland.....	1,840,337	1,623,390	129,540*	935,670*
New South Wales	803,727	769,353	69,774	117,093
New Zealand.....	1,896,332	1,808,049	106,692	1,308,668
Victoria	2,422,700	2,138,000	225,200	1,487,000

* August figures only.

SALE OF TIN CONCENTRATE AT REDRUTH TICKETINGS.

	Tons	Value	Average
Year 1911	61813	£305,599	£114 4 5
Jan. to August 1912	42364	£213,138	£113 0 8
September 2	234	£1,000	£134 13 8
September 10	285	£39,390	£136 17 9
September 30	285	£33,505	£140 1 3

EXPORTS OF TIN AND ORE FROM STRAITS AND BOLIVIA.
Reported by A. Strauss & Co.

	1911 tons	Sept 1912 tons	1912 tons
Metal from Straits to Europe and America	55,135	5,440	43,067
Metallic Content from Bolivia to Europe	22,577	1,727	15,511

REVIEW OF MINING

INTRODUCTORY.—Again the mining markets have been depressed by the threat of a European war. The Balkan crisis came down upon the Stock Exchange like our autumnal fog and plunged the business centre in sudden gloom. Meanwhile the revival of business has been checked. But more at Berlin and Paris than here. At the German capital the carry-over facilities are provided by the banks, and these are likely to withdraw support whenever international complications are impending. Our French friends also have been carrying a large account in Russian industrials, the market for which has been supported by the Russian banks, and if the latter were to withhold support a collapse would ensue. The Russian speculator is new at the game. In London, on the other hand, the mining business is on an entirely different footing; the shares are more widely distributed, and more digestible financially. Money borrowed from banks plays an insignificant part in mining speculation. Hence our market is not so easily paralysed by wars and rumours of wars. The first breath of impending trouble caused a scare on the French and German bourses, followed by free selling in London. This affected Rio Tinto and other international stocks. Nevertheless, an undercurrent of strength has been manifest and the mining market as a whole has suffered from inactivity rather than collapse. Conditions are good, especially in base-metal mining. Tin has continued to rise; lead and zinc are strong. Copper continues high, despite wider activity in production, simply because consumption is adequate to absorb the supply. Silver also is maintaining a high quotation, largely on account of the necessities of China. This should help the miner, not only in Mexico, but in the many districts where silver is won as a by-product from gold, lead, and copper ores.

We refer elsewhere to the improved outlook on the Rand. This is bound to exert a sympathetic influence on other departments. Rhodesian and West African shares are dull. At Broken Hill a cheerful tone persists, as might be expected, having regard to the price of lead and zinc. Labour troubles still punctuate other Australian operations, but the strikes at Waihi and Mount Lyell appear to have been settled once again. Siberian ventures are honourably prominent. South American business is gaining in quantity, but the quality is poor. Mexican shares are surprisingly firm considering the continued political disorder.

TRANSVAAL.—The August statistics of production had no effect on the market, as the output of 764,737 ounces of gold, worth £3,248,395, was normal. The slight decrease, as compared with July, was wholly covered by the temporary diminution at the Crown Mines. In September the output was 747,893 oz., showing a slight loss. The labour statistics were not so pleasant, showing a further decrease of 3814 during the month, and a total of only 179,111 natives at work on the gold mines, as compared with 179,811 a year previous. As the total of natives employed has increased from 199,284 in August 1911 to 203,811 in August 1912, it is apparent that the diamond mines have been attracting an undue proportion of the supply. From this time forward the decrease at Johannesburg should be small, until the customary seasonal migration comes around once again, but it is only too apparent that the efforts to recruit a larger supply have failed. A scarcity still exists and will continue to cripple productive operations at some of the mines, namely, those not fortunate enough to obtain their full quota. For September an increase of 1628 is recorded, the figures being 180,739 employed at the gold mines.

The comparison of yield, cost, and profit per ton shows that the mines of the Rand yielded an average of 28s. 9d. during August; this is 2s. 1d. more than it was a year ago, from a tonnage approximately the same. The cost per ton meanwhile has risen from 17s. 9d. to 18s. 10d., and the profit has increased from 8s. 11d. to 10s. per ton. The most significant of these figures is the cost, which continues to increase with the additional expense incurred for labour, owing both to the inadequacy of the supply and the expenditure incurred in recruiting. The total 'profit' of £1,055,315 in August 1912 as against £967,457 in August 1911, shows a gain, but it must be accepted with reserve, simply because the so-called profit is not synonymous with dividends.

While the Far East Rand is coming to the fore, it is interesting also to note the good results being obtained at the other end of the goldfield, where the West Rand Consolidated is showing symptoms of revival. This property (of which Mr. Robert Pill is manager) lies between the Randfontein Central and the Lancaster West. Development is being centred on the Battery reef, which has been explored from the Rand shaft on the 3rd, 4th, and 5th levels. In the lower of these workings the assay-value has increased to over an ounce per ton for a full stoping-width. This confirms Sir George Albu's cheerful speech at the annual meeting. The increased yield in the mill is now reflected by enlarging profits.

The sale of the Simmer & Jack East to the Knights Deep company (backed by the Consolidated Gold Fields of South Africa) for £250,000 closes the career of an unfortunate enterprise born in the boom period of 1895 and fathered by the Consolidated Gold Fields. On an issued capital of £650,000, once quoted at 4 $\frac{3}{4}$ per share, or £3,087,500, no dividends have been paid. By the sale, the shareholders get nothing; the second debentures (of which £366,700 survive) will get interest only for nine years more, in accordance with a guaran-

tee given by the Consolidated Gold Fields, which also guarantees the principal and interest of the £400,000 in first debentures still outstanding. In July 1911 the reserve of ore was estimated at 934,000 tons, averaging 5'4 dwt. per ton. The question arises: What will the new owners do with the mine?

Further good news comes from the Far East Rand, where the good showing in the No. 1 shaft of the Modder Deep has been confirmed by a cross-cut, at 50 feet from the shaft, exposing 10 feet of 9 dwt. ore, as compared with the 10 feet of 8'84 dwt. ore in the shaft. We hope the Government Areas may also have better luck as development progresses.

RHODESIA.—The August statistics show a slight decrease as compared with July, but the total output nevertheless may be considered satisfactory, having regard to the general scarcity of water for milling. Among the individual mines no notable variation of production is recorded. The postponement of the Globe & Phoenix dividend was due to the water scarcity, the directors deeming it best not to distribute the second interim dividend for this year unless they were assured that the mill could be kept at work. As the dividend was announced on October 2, it is to be assumed that the anxiety as regards water has been removed.

It is said that Mr. Sam Thomson corroborates the estimate of 950,000 tons of 10 $\frac{1}{2}$ dwt. ore in the Cam & Motor mines. What is needed now is a confirmation of the estimated cost, not the 'operating' cost or any other incomplete figure, but the whole cost to be deducted from the 10 $\frac{1}{2}$ dwt. per ton, after allowing for loss in treatment. It is announced that the Selukwe Columbia company has acquired the Wonderland and Forest King groups of claims, and has taken an option on the Danga and Chimborazo claims, which are near that company's Yankee Doodle mine. Mr. H. A. Piper confesses that the deeper development work in the Globe & Phoenix has

not cleared the complexity caused by disturbed ground. Some rich ore, however, has been found.

It is reported that Mr. Charles Henrotin has been engaged by the Tanganyika Concessions, with a view to re-organizing the technical work and with power to select, if necessary, a copper expert for the further solution of current problems. Mr. Henrotin was for many years at Kimberley, and went thence to Canada; he is honourably known in the profession and is believed to be a man who knows his limitations: a quality most useful at Katanga, where over-confidence and technical inexperience have led to a failure much to be regretted.

WEST AFRICA.—The statistical record continues to improve, even if the dividend record remains inglorious. In August the total output of gold was 33,015 ounces, worth £136,407, this being an increase of £8607 as compared with July. The Abbontiakoon is again a contributor, but the return is meagre. The dredging companies did not do quite as well, owing to low water in the rivers. The Prestea increased its production to 17,417 tons, yielding £27,089, while the Ashanti maintained its normal output of about £40,000.

The Abbontiakoon returns on the resumption of milling reflect the general character of mining operations in West Africa. The profit, exclusive of development and London charges, was £4227 on 6570 tons of ore. As London expenses last year averaged £900 per month and development about 5s. per ton, the cost was about 33s. per ton, on a yield of 38s. per ton. When the mill is crushing at its full capacity of 11,000 tons monthly the average cost will be reduced, but the net resultant profit to the shareholders will prove disappointing. The reserve is estimated at 643,000 tons of 10 dwt. ore, equal to 42s. per ton; allowing for loss in treatment, the yield would be about 38s. per ton, leaving a profit of about 5s. per ton, or a total of £165,000 on a market valuation of over £400,000.

Since the above was written the September return has been published, showing a yield of 3332 oz., from 8000 tons, and a profit of £2852. This is a real profit, for head-office expenses and 5s. per ton for development-redemption have been deducted.

Production of tin in Northern Nigeria has been reduced by conditions that are temporary, such as shortage of corn and consequent insufficiency of food for large gangs of workers. Transport also has been affected by the wet season. Hence a temporary breakdown. These difficulties are being corrected. About 9000 natives and 150 Europeans are now taking part in various mining operations in Northern Nigeria.

AUSTRALASIA.—The Talisman reports a poor development in depth. The history of this mine is that of optimism that has been intermittently justified. Thrice have the shares been sold by the New Zealand holders during a boom, only to be bought back in London when the bottom dropped out. The market valuation has repeatedly been at twice the amount of profit assured. Yet the annual dividend has been paid and the quotation has been maintained at a high premium. According to the latest figures available, the 98,800 tons of ore in reserve has a gross value of £592,000, from which a profit of £335,000 may be estimated, equal to 19s. 6d. on the 345,000 shares. From the 12th level downward the veins have narrowed and the rock enclosing them has changed in appearance. The Waihi story is a warning. It would be well to allow the New Zealand shareholders to increase their holdings. The mine should be controlled by local owners, able to keep a sharp eye on developments. Incidentally, we would like to add that the Talisman is exceptionally well managed by Mr. H. Stansfield.

At the Sons of Gwalia the exploratory work on the lower levels, especially the 18th, was disappointing southward, but recent developments have proved that the drift was not in

the orebody, which has now been found in the hanging wall. A drift for 278 feet has been in ore averaging 34s. for its full width. A winze also has been sunk in excellent ore to 137 feet and a rise has followed the orebody (averaging 37s. per ton) to the 17th level, where it is now being tested by a supplementary drift. The general result is to indicate that the main orebody of the mine continues in depth and gives promise of yielding handsomely. In the southwestern part of the mine the developments continue satisfactory.

The Great Fitzroy makes a better return. The profit is only £2000 for the month, but the extraction in the mill (by Minerals Separation) has been raised to 85% on the copper, and it looks as if a favourable turn had been made in the fortunes of this unhappy undertaking.

On October 2 it was announced that more than 200 men have been put to work at the Waihi, in the face of a hostile, but futile, demonstration by the strikers. At the Mount Lyell there has been another labour outbreak the men employed underground having stopped work. This outbreak, however, was reported on October 7 as having been settled. From the Waihi also a general resumption of work is announced.

The Hampden Cloncurry has come into prominence by reason of the authorization to increase the capital by 100,000 shares, which have been taken firm by Lionel Robinson, Clark & Co. This copper mine is said to be able to produce 650 to 700 tons of copper per month, for a profit of £40,000 per month, at present metal prices. The reserve is believed to be 250,000 tons of 12% ore. The McGregor-Cloncurry mines are being acquired by this company on the basis of 7s. 3d. per share, or about £108,000 for the property. The latter has not the equipment required to treat its ore, which again is of a basic character admirably adapted for making a smelting mixture with the ore from the Duchess mine, of the Hampden Cloncurry. Among the engineers who

have inspected these mines are Messrs. F. Danvers Power, F. B. Powell, and W. H. Corbould.

The profits of the North Broken Hill indicate a substantial increase in the dividend, even if the directors should consider it more advisable to split the shares and re-organize the company so that bearer stock can be issued.

The length of time taken by Mr. Richard Hamilton in his testing of the Victoria mine, in the Yilgarn district, suggests that the Great Boulder is likely to acquire this property. The developments in the Golden Horse-Shoe on the 2500-ft. level indicate the existence of a very short shoot of rich ore, with a quantity of poor stuff beyond this limit. The Ivanhoe is looking lean on the bottom level.

INDIA.—The North Anantapur mine may now be considered as an established success. An important orebody has been proved between the 150-ft. and 450-ft. levels, and a large part of it averages $1\frac{1}{4}$ oz. per ton over 4 feet. The improvement in the assay-value of the ore treated during the past year is notable. A year ago the yield was 5 dwt., and now it is $7\frac{1}{2}$ dwt. The September production was 750 oz. from 2000 tons of ore, these being record figures for both yield and output. The mill is being enlarged to 30 stamps, and the monthly capacity thereby increased to 3000 tons. From the Kolar district the most interesting news relates to the Champion Reef, where the lode on the 43rd level north of Carmichael's shaft is proving to be rich, the assays averaging 25 dwt. over a width of 6 feet.

RUSSIA. — On September 27 it was announced that the miners concerned in the disturbances on the mines of the Lena Goldfields had all been dismissed. Thus 6000 workmen, with their families, left Irkutsk. About 1000 of the old hands remained and since then over 3000 fresh workers have been imported, so that the total is now 4226, as against the 6193 employed at this time last

year. This, of course, presages a diminished output of gold for the current year, to the extent probably of one third less.

The dredge on the Kolchan placer of the Orsk Goldfields is doing well, the August returns being about the same as July. The stacker-scow at Pokrovsky did considerably better in August than in July. Unfortunately the yardage is not published in either case, so that the information is defective.

No recent report has been issued on the Tanalyk, but it undoubtedly makes a fine showing at surface. The copper ore contains gold also. Another examination is to be made shortly by Mr. R. Gilman Brown. The chairman of the Tanalyk Corporation is Mr. Leslie Urquhart, who is also managing director of the Kyshtim, a highly successful enterprise. The shares have been boosted to £4, on account of the extension of the lease on the 9590 acres covered by the property and the grant of prospecting rights over 3000 square miles of territory. Before adequate dividends can be paid it will be necessary to spend a good deal of money on plant and equipment. To do this will require the issue of more capital.

MEXICO.—We discuss Mexican affairs on another page, and we publish a letter from Mexico City. Our San Francisco correspondent also refers to the subject. Obviously the situation has not improved, but the Government appears confident of gaining the upper hand, and we are disposed to believe that a sudden improvement is at least as likely as a further deterioration in the general state of affairs. Mining has not been hindered to any serious degree in any of the larger centres, but isolated operations have been stopped by brigandage. It is remarkable that exports and imports increased in 1911, according to consular reports, despite the disturbed condition of the country. It is significant, however, that the import of arms and explosives nearly doubled in value in 1911 as compared with 1910. It is also a fact that the embargo placed

by the United States on the export of arms and ammunition is sure to be a factor, possibly a decisive factor, in terminating the present revolution.

The finding of good ore on the San Carlos vein at the 12th level is an important step in the development of the Esperanza. The same orebody on the 11th level has been traced for 1200 feet in a large undeveloped area and has been followed in four rises midway to the 10th level. It remains to ascertain how far it reaches upward and it also remains to be shown whether the San Carlos is a new vein or only the continuation of the West vein, which yielded the big bonanza of the mine. Mr. H. A. Titcomb expressed the view that the branch veins ceased to be productive when they joined with the main lode, the San Rafael vein, and he was inclined to take a sober view of the chances on the San Carlos.

UNITED STATES.—A notable event is the issue by the Alaska Gold Mines Co. of 614,700 shares (of \$10 par value) at \$5 per share. This issue was subscribed four times over. The \$10 shares, with \$5 paid, are now quoted at \$9½ in Boston. The affair is in the hands of Hayden, Stone & Co., acting on reports by Messrs. D. C. Jackling and A. F. Holden. The Alaska Mines Co. is capitalized at \$7,500,000 in \$10 shares. The 135,300 shares unissued are to be reserved for the purpose of acquiring, if possible, the debentures and shares of the prior company, the Alaska Gastineau Mining Co., a British enterprise, which itself was successor to the Alaska Perseverance, a company organized in New York. Col. W. J. Sutherland was identified with the earlier venture and Mr. Arthur L. Pearse is the engineer whose plans are now destined to be carried out by the new company.

The report of Mr. W. P. Hammon indicates that the Oroville Dredging Company will earn an increased profit from the operations in California during the financial year to July 31, 1912. It was expected that the company's

receipts would have been expanded ere now by the operations on the Pato property in Colombia, but the new manager, Mr. McConaughy, who assumed charge in June, announces that the dam cannot be completed until November 15, and that the dredge is to be ready a month later. In our last issue we published an unprejudiced opinion by Mr. George Tilly, who happens recently to have been on the Pato property. His opinion was more favourable than we should have anticipated. We confess to a prejudice against the companies controlled by Mr. Hammon, because he is so chary in giving prompt information. This is a mistake made by many clever men, who fail to understand how much it lessens public confidence.

The old Camp Bird mine is evidently not dead yet, for on the 5th level, that is, 700 feet below the Gertrude tunnel or main adit, some good ore has been found. When first cut it was 7 ft. wide and assayed \$35, and since then it has been opened-up for about 150 ft., averaging \$25 to \$30 per ton. On the 4th level the same ore-shoot has been opened-up for 200 feet. At the Santa Gertrudis the political unrest has not interfered with operations. On the 18th level the main drift is being extended from both winzes in productive ground, so far as tested.

The Tomboy, in Colorado, is making £8000 profit monthly, and is likely to fulfil all expectations, for the Montana property, acquired last year, is opening-up well. This lode varies in assay-value, but, like the Argentine, yields a good average ore.

CORNWALL.—The comparative failure of Nigeria as a tin-producer has served to divert attention once more to Cornwall. Messrs. Bewick, Moreing & Co. are undertaking the management of the Phoenix mine at Liskeard, and Messrs. Bainbridge, Seymour & Co. are re-opening the Mulberry at Lanivet. The Killifreth, near Chacewater, is to be reopened. Schemes are on hand for dredging the shore at Gwithian beach at the mouth of the Red

river, the stretches of sand on the Carnon river, and the sand in Looe Pool, near Helston. The shareholders in Carn Brea & Tincroft are receiving rare and refreshing fruit in the form of a dividend of 5% on the £50,000 priority shares. The Geevor company has issued an excellent report, showing solid progress. Mr. R. Gilman Brown, the technical director, sets an example, which might well be followed by others in Cornwall, of publishing a plan of the workings and giving a definite estimate of the ore in reserve. The mill is to be enlarged so as to treat 100 tons per day, and additional plant is being erected for the purpose of improving the extraction. Stage crushing has been adopted.

VARIOUS.—Madagascar's output of gold in 1911 was 92,022 ounces, as compared with 104,002 ounces in 1911. Most of this is won by natives operating in a primitive way. Efforts to revive European interest have failed, for Madagascar still suffers from the reckless promotions of an earlier period.

The Butters Salvador issues a cheerful report from the resident director, Mr. M. Frank Perry. He estimates the ore reserve at 76,219 tons, averaging 1'3 oz. per ton. He says 1'328, but we omit the meticulous decimals. The new plant is fulfilling expectations, and the mine developments are excellent. The threatened litigation has been overcome.

The Famatina enterprise is to have another chance, after many disappointments. We congratulate the shareholders on their new chairman, for Mr. F. H. Hamilton brings to mining affairs a clarified common-sense that is always invaluable. We understand that the work of erecting the matte-smelter and improving the metallurgical treatment is going forward most satisfactorily. Mr. Walter G. Perkins is designing the plant, and Mr. E. J. Carlyle is the metallurgist on the spot. As stated elsewhere, Mr. Arthur W. Jenks has resigned as general manager and is succeeded by Mr. Llewellyn Parker, formerly mine superintendent.

EDITORIAL

WAR is again the perturber of industry. The Balkan countries are relatively unimportant in metal mining but they are an important source of oil, especially Rumania. Military operations may also interfere with work in the Caucasus, notably Baku and Maikop. We all hope for a limitation of the area affected. Meanwhile the mining market is fairly steady, the notable exceptions being international stocks, such as Rio Tinto, De Beers, Central Mining, and the Modderfonteins. Some of the Mexican shares are also affected by selling from Paris.

TIN continues to rise and in the wake of the rising quotation comes the organization, most naturally, of new ventures in search of the metal. We are interested to know that Messrs. H. C. Hoover, W. J. Loring, R. Gilman Brown, and other American engineers of wide reputation have taken a hand in the revival of Cornish mining. Meanwhile the Tronoh, Gopeng, and Kinta prove that Cornishmen are successfully extending their enterprise to the Malay States. Thus the experience of one region is used beneficially in another.

AS NOTED in our last issue, Mr. George A. Denny has been elected president of the Mexican Institute of Mining and Metallurgy. This election can hardly enhance the reputation of a mining engineer already so honourably known, but it ought to help the Mexican Institute, which is suffering owing to an exodus from a country where conditions are temporarily unfavourable to legitimate industry. Mr. Denny has put his hand to the wheel when the vessel is in the midst of a storm, but he is a good pilot for any technical society, and we wish him every success.

WE TAKE PLEASURE in publishing a letter from Sir Alfred Keogh, the Rector of the Imperial College of Science and Technology, of which the Royal School of Mines is now a part. As formerly Chief of the Sanitary and Medical Service of the Army and now the administrative chief of the Royal School of Mines, he is doubly qualified to speak on the subject of the mining engineer's health in the Tropics. We note from Sir Alfred's letter that the lectures at South Kensington include a series on hygiene delivered by a professor in the Royal Army Medical College. This information will interest the profession generally and should be made further known, so that mining engineers may take proper advantage of the opportunity to obtain a kind of knowledge at least as useful to them as mechanics, mathematics, physics, or mineralogy.

AS A SEQUEL to the foregoing, we regret to record the death of Thomas Lane Carter, the author of the article on 'The Engineer in the Tropics,' published in our July issue. He was killed by an accident in the Polaris mine, near Dillon, in Montana. He was carrying some samples in both hands when he stumbled and fell into an old stope, 200 feet deep. The tragedy is all the more pathetic for the fact that Mr. Carter had recently been married, and his wife had accompanied him while performing this particular professional engagement. At Johannesburg the news will sadden many friends, for he was long associated with the Crown Deep and Robinson Central Deep mines. As a contributor to the technical Press, Lane Carter had won an honourable prominence, for he wrote with an intelligence and humanity that made his writings keenly interesting.

MOTORISTS will be interested in reading that part of the news-letter from our San Francisco correspondent in which he discusses the consumption and cost of 'gasoline,' as it is called in America. In England we use 'petrol' or 'motor spirit' as a synonym. In California the retail price is 20 to 22 cents, that is, from 10 to 11 pence, per gallon. In London the price is 18 pence per gallon, mainly because the source of our supply is largely controlled by a monopoly. Even the existing exorbitant price is likely to hold because the demand is growing too fast for the restricted natural output. In this connection it is interesting to note that benzol made from the by-products of coke-oven gases is now extensively used as an alternative for petrol especially in France and other European countries. We also publish an article on the Coalinga oilfield, as viewed by one who is not a specialist in such matters, but shares the interest in the subject felt by many of our readers.

THE EL ORO meeting affords an excellent example of the frankness for which we continually plead, in behalf of shareholders and for the good repute of the mining business. In this, as in other matters, the chairman of the El Oro Mining & Railway Company, Mr. R. T. Bayliss, has consistently exhibited a standard of conduct for which he cannot be too warmly thanked by all those who have at heart the best interests of the mining industry. The reading verbatim of the letter from the manager, Mr. A. F. Main, was a happy idea and emphasized the position adopted by the directorate. The letter from Mr. R. M. Raymond, the consulting engineer, stating that he found evidence to prove that the vein-fissures penetrated the andesite, as well as the shale, and therefore were formed after the intrusion of the former into the latter, is encouraging to further exploration in depth. The replies to questions and criticisms from shareholders were ample and convincing.

Apparently, the policy outlined by Mr. Bayliss a year ago has been followed faithfully, and has been completely justified. Developments have not been without encouragement. The El Oro mine has seen its best days, as have its neighbours, but it is far from finished. Great mines die hard. When it does come to an honourable end, many years hence, it will have left a chapter in the records of mining of which no one will need to be ashamed.

DAILY PAPERS recently recorded the theft of six gold nuggets from a showcase in the window of the Canadian Government Emigration offices in Whitehall. These nuggets came from the Yukon and were exhibited with a view to influencing emigration to the Northwest. We regret the theft and hope that the thieves will be caught, but we are not sorry that the nuggets should be missing from the window of the Emigration Office. It is not fair to lure ignorant men to go to Canada by such misleading evidence. As a matter of fact, the Yukon diggings were never remarkable for large nuggets, the biggest being one that was found in 1903 at the mouth of French gulch and Eldorado creek. This nugget weighed 86½ ounces. Mining in the rich alluvial deposits of the Yukon territory is today rendered profitable not by the finding of nuggets but by the successful exploitation of gold existing in relatively small particles on the bedrock. It is a mistake to emphasize the spectacular aspect of mining. The industry is sufficiently genuine to need no veneer of fictitious romance.

IN our Précis of Technology we give the gist of an interview with Mr. H. C. Hoover, appearing recently in the New York *Sun*, on the future output of gold. The views expressed by one so well informed are necessarily interesting and suggestive. Mr. Hoover lays stress upon the skimming of the cream, that is, the exhaustion of the placer deposits

of Europe, Asia, and Australia. He points at the decadence of lode mining in Australia and South Africa, and he concludes that the chances are small of discovering any new goldfield of international importance. Diminishing chances of metallurgical improvement and the higher cost of labour unite to prevent expansion of output. Thus he takes a gloomy view, which we do not wholly share. We believe that gold mining in its world-wide aspect is only passing through a period of arrested expansion. One example may suffice: The Cripple Creek goldfield lay fallow from 1859 to 1891. It was repeatedly crossed by prospectors on the way to Leadville, and it was under the very shadow of Pike's Peak, the beacon mountain of the pioneers. Our search for the precious metal is, we hold, much too fortuitous to warrant the belief that large areas in different parts of the world have been exhaustively prospected.

SOME of our readers are aware that we avoid the use of the preposition-verb (such as 'make up,' 'fill in,' 'meet with') and we even venture to advise other technical writers to abjure the use of this clumsy locution. We note with curiosity that the first paragraph of a voluminous and highly interesting account of the development of printing, published by *The Times* to celebrate its 40,000th issue, contains two disfigurements of the kind to which we have referred. Thus the learned writer says: "Papyrus, which for many centuries was the writing material of the Western world, was much too brittle to print on." Also: "When the movable types invented by Pi Shing were found too trouble. some to work with the Chinese went back to printing from wooden blocks, with which an edition of their classical books had been published as early as 922, and which are still in use." We quote freely because the sentences quoted afford interesting information, while also illustrating the point at issue. In the first

quotation, "print on" ends a sentence clumsily. The writer might have said that the papyrus was too brittle "to receive print" or "for printing." In the second, "work with" runs into "the Chinese," so that the idea of working with them crosses the mind; again the "work with" jars against the "with which" in the next clause. Similarly the "and which" is unpleasant in sequel to "with which." Thus even the Thunderer will err.

THE BANKRUPTCY of Sir Cornthwaite Rason is a melancholy event in the career of a man formerly distinguished in the public service. We do not refer to it in order to add to the disgrace of one who was not long ago the Premier of Western Australia and subsequently the Agent-General for that State; we mention it only to drive home the assertion made often in these columns, namely, that eminence in political service or in public administration does not afford proof that a man is fitted to be a director of mining companies and a trustee for shareholders in such companies. Sir Cornthwaite Rason was a director in several companies that we have had reason to criticize for the flamboyancy of their prospectuses and the insecurity of the assumptions underlying their issuance. After his retirement as Agent-General, three years ago, he became a director of companies and obtained a living thereby. Fortunately for him, and others like him, but unfortunately for the public, it is generally supposed that a Premier of Western Australia must know a good deal about gold mining. Such beliefs cause promoters to place on their directorate the names of men conspicuous in ways of life involving no knowledge of the technique of a complex industry. Thus the name of Dufferin was used as a lure by Whitaker Wright and brought to abasement by financial misdoings over which the owner of that honoured name had no intelligent control. Thus have other proconsuls of empire, governors of states, ad-

mirals, and generals, not to mention peerages illustrious only in prospectuses, been used as a means of pleasing the snobbish greed of unthinking speculators. It is time the farce were played out. The only person whose opinion on a mine is worth having is that of an experienced mining engineer, and the only director for an industrial enterprise is a man of business training in affairs akin to those involved. If the mining engineer is also a business man, then he is peculiarly fitted to be a director of a mining company.

AMONG the publications issued by the American Institute of Mining Engineers none have been more keenly appreciated than those devoted to the study of ore deposits, more particularly the separate volume containing the collection of papers by Posepny, Van Hise, Kemp, Lindgren, and other acknowledged authorities. It was announced recently that a further volume on the subject was to be issued, edited by S. F. Emmons, who was enabled to complete his editorial work before his lamented death last year. This sequel to the Posepny volume will now serve as a memorial to Emmons, who did more to apply geology to mining than any other geologist, and it will supplement the earlier 'Genesis of Ore Deposits' so effectively that we venture to urge the management of the Institute to hasten the publication. It appears that there is some doubt as to the expediency of completing the undertaking forthwith, but we trust that any such doubt may not long prevail. And in speaking of this Emmons volume on ore deposits we take the opportunity of reminding our readers that a research fellowship of economic geology is being founded as a memorial to the services rendered to science and to industry by Samuel Franklin Emmons. Subscriptions should be sent to Mr. B. B. Lawrence, at 60 Wall Street, New York. We would urge our mining engineering friends, especially those who appreciate what Emmons

did for economic geology, to contribute to this useful and appropriate memorial.

Rand Problems.

The better feeling in regard to Transvaal mining has been reflected in rising quotations and there was reason to expect that the recent improvement would have continued if the Balkan crisis had not frozen the warm current of reviving speculation. Undoubtedly the Rand is a great mining centre, not only because it produces 38% of the world's annual output of gold but because it is the scene of an interplay of forces, political and industrial, so complex as to provoke unflinching interest. That interest was heightened by the grant of self-government to the Boer states, and by the organization of a new political party intended to check the Dutch domination. The new party was organized by the mine operators with the idea of self-protection. It may have been a clever move, but it was not a wise one. Far better might it have been for the 'groups' and 'magnates' in control of the mining companies if they had utilized the existing political cleavage, which was old and deep, instead of crossing it with one that was so superficial as to add merely to the complexities of the position. In the Transvaal, as in any country recently industrialized, the natural cleavage is between the labourer and the landlord. This conflict, between the land-owning part of the community and the wage-earning part of it, goes deeper than any of the quarrels arising from race-antagonism, which is also obscured by the overlapping of differences between those who make their homes in Africa and those who sojourn there only while making money. We hear that the Unionist party in South Africa is decrepitating. It is well. The present party demarcation is not good for the mines. To-day the Boer is a better friend to the mining industry than the labour agitator. Indeed, there is reason to believe that there exist un-

reasonable creatures who sigh for the days when they had Kruger and their grievances. The bad times were better than the good times that never came.

Meanwhile not only has labour scarcity handicapped operations, but the efforts to replace the white by the black has created new difficulties. As regards native labour, we believe that the crisis is nearly past, because the lack of an adequate supply is being mitigated by increased efficiency due to the use of machine-drills, and by the slackening of demand due to diminishing expansion in mining development. The Rand is near the zenith of its production and close to the limit of its expansion as a goldfield. As old mines become exhausted and idle, their quota of labour will be rendered available for other and newer enterprises. Therefore the dearth of natives for the ordinary unskilled work of the mines will not be felt much longer, looking at the position in a broad way. It may continue to be felt for six months or a year, and it may affect individual mines a little longer, but it is a passing phase. Not so the difficulty with white labour. This is only beginning.

The untiring effort to cheapen the cost of mining is hastening the more general use of machine-drills; this involves the employment of additional skilled white labour, the making of more dust in the stopes, and an increase of phthisis among the miners. Much has been done, and is being done, to combat this disease. More will have to be done. The housing and feeding of the men, already better than on any other of the great goldfields, must be improved to the standard now set by the Brakpan, City Deep, and other mines. Bathing and sanitation must receive expert attention. The use of water-sprays underground must be extended systematically. By such means it will be possible to prevent the spread of phthisis and to make the men content with their employment. Thus also the managers can win the support of their men as against the agitators to whom

a labour-union is not a method of collective bargaining and a necessary protection against tyranny but merely a stick of dynamite to be exploded under an industrial enterprise whenever the walking-delegate feels himself losing in importance.

Another problem calling for serious consideration is the discontinuity of management. Not a dozen men now in charge of mines at Johannesburg have held their position for more than five years. Owing to the shiftiness of the financial control, the managers and their staffs enjoy a precarious tenure of office. In some cases the blunders made by those higher up have called for a scapegoat; in other cases the exigencies of share-dealing have led the controllers to ask the managers to depart from a carefully considered policy and to incur risks that involved a subsequent fiasco. These unpleasantnesses have hurt the industry, not only by lessening public confidence but by undermining the loyalty of the men on whom after all rests the chief burden of a colossal work. A succession even of brilliant managers is less likely to ensure efficiency than a manager of average ability, familiar with a given mine, with a well organized staff, and the cordial support of his directors. Supermen are rare: one of the lessons of recent Rand history is that a super-mine can be made by lavish consolidation, but the man capable of a perfect control of such vast operations is hard to find. The consolidation era is, we hope, past; except as regards amalgamations based on other reasons than mere size. Consolidation has not given increased economy; it has been a means of carrying lame ducks to water and of covering blunders of mine valuation. There is an economic unit in mining; that unit has been exceeded in several cases. It remains to make the best of the position, but not to repeat past performances.

Another problem, and a cheerful one, is the metallurgical. The last three years have seen several noteworthy improvements; we refer

to the Butters treatment of slime by vacuum-filtration and the Merrill system of precipitating gold by means of zinc-dust. The Nissen stamp also has scored. Other devices have been, and are being, tried. Metallurgical ingenuity on the Rand is much alive. Anything new and authentic will receive a fair trial. Indeed, the catholicity of those in control is much to their credit. The next line of advance is the separation of the 5% of pyrite in the sand after classification. This 5% contains 70% of all the gold in the sandy product. Some method of concentration is required. Perhaps oil-flotation may prove effective. This marvellous physico-chemical process is only half-understood as yet and gives promise of wider adaptability. However that may be, the expectation of improving existing methods is reasonable. But that expectation must be restrained. After all there is only 100% of gold to be extracted. But the same percentage as is now obtained may be won more expeditiously, more certainly, and more cheaply.

Nevertheless, we venture to suggest that it is underground, in the mine, where the saving is to be made. Of the total cost of operations 60 to 70% is incurred in the mine. Experience shows that wasteful methods are detected much less easily underground than at surface, and that good work is less likely to be appreciated in the mine than in the mill. Milling is provided with checks, the operations can be viewed without discomfort, they are readily open to comparison. In a given district the ore in all the mines may be so nearly uniform as to permit of similar treatment by similar plants. Comparison becomes obvious and easy. But no two mines present exactly the same practical problems, and only an expert can pass criticism. Hence intelligent criticism is rare. It is the good shift-boss, and the man that knows how to select him, that will be best able to reduce the cost of mining on the Rand.

It remains to refer to improved prospects. In our last issue we discussed the encouraging

aspect of developments in the Far East Rand. This is undoubtedly important, and promises to lead to a notable expansion of productive operations. At the other end of the Rand, the West Rand Consolidated has been finding better ore in the Battery Reef series. Furthermore, it will be remembered that the farther outlying West Rand Estates in 1903 sunk boreholes to 1675 and 2200 feet, respectively, and cut rich blanket. A bore driven to 3188 feet also found a narrow width of rich stuff. Subsequent shaft-sinking was stopped by excessive water. We shall be surprised if an effort is not made to resume exploratory work. Thus the growth of the goldfield will not cease abruptly. Meanwhile the Central Rand is doing better, for in the Village Deep, City Deep, Rose Deep, and neighbouring mines the prospects have improved in the deeper workings. The Crown Mines also is getting into a better position. On the whole therefore the auspices are favourable. It remains to appreciate them without exaggerating them. No boom is necessary or desirable; a period of depression has been passed; that is all. Money remains to be made by mining on the Rand, but this is not the equivalent of making money by exploiting public credulity. More of the mining must be done in South Africa; less in London.

Mexican Affairs.

After another month we are unable to see light through the dust-storm of Mexican disorder. Letters from engineers living in the country are contradictory, as might be expected, for Mexico covers a vast territory, the parts of which enjoy not only a variety of climate but a diversity of political local government. For instance, in the state of Hidalgo the conditions do not hinder mining operations; in the state of Chihuahua, chaos has reigned for months, and both mining and smelting operations are at a standstill. Moreover the points of view vary. Some of our

friends care not at all about the development of the political institutions of Mexico and sigh for another Diaz, to rule the country with a rod of iron and to give a friendly hand to the foreign concessionaire. Others there are perhaps who share our hope that stability of political institutions may be found not incompatible with some form of representative government and that reasonable opportunity for foreign participation in exploiting the natural resources of the country may not degenerate into a tacit conspiracy to rob the Mexican people. Whether President Madero is only a sentimental philosopher on horseback or has indeed got the capacity of a chief executive is a question that we hoped the logic of events would answer favourably. We are beginning to doubt his ability to stem the tide of discontent. He asked the Congress for authority to issue a loan of 20,000,000 pesos. He was given the authority to do so. The loan was placed successfully and the money has been spent. It was to meet the cost of forming a standing army able to cope with organized brigandage. But Orozco, Zapata, and the other chief bandits are still terrorizing peaceful industry. Now another loan of 20,000,000 pesos is to be issued. Meanwhile the condition of the country has been so little improved that many are hoping either that a masterful insurgent will arise, able to force the position and sweep aside the present leaders on both sides, or that the United States will intervene. Intervention would, we believe, prove calamitous to the United States and to Mexico. It would cause all the present factions to unite against the new enemy, it would jeopardize the life of every foreigner in Mexico, it would postpone indefinitely the restoration of order. It would be another Boer war. Meanwhile the persons and property of foreigners are fairly safe from attack, and even their operations have been stopped only in isolated localities. Intervention would make things ten times

worse than they are, and for a long period. No; the salvation of Mexico must come from within, by a realization on the part of the business and professional classes that their only hope of a reasonable life is to support the Government for the time being, and to get rid of that Government, if it be incapable or corrupt, by constitutional methods at the next election. This idea is gaining ground in Mexico, and if it once bites into the intelligence of the dominating class it may save the situation.

Extraction Problems.

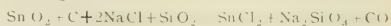
At the present time the greatest opportunities for metallurgical ingenuity are undoubtedly offered by the metals tin and copper, not in the smelting operations only, but as regards the total extraction of the metallic content of the ore. It is true that after years of anxious experiment it has been possible to extract by mechanical means sufficient copper from the great low-grade deposits to make their exploitation profitable, but by present appliances less than 70% of the metal is recovered. A mine containing 10,000,000 tons of ore averaging 2% loses 60,000 tons of the metallic copper content. Such great stores of untapped wealth afford sufficient field for metallurgical progress, and, as a matter of fact, are receiving the close attention of experts in oil-flotation, centrifugal concentration, and chemical treatment. The margin between content and recovery is still greater in the case of tin, for not only is the extraction by water-concentration low, but the vanning-shovel assay, on which the results are calculated, shows considerably less tin than there actually is in the ore. The discrepancy between the content and recovery was forcibly emphasized by the announcement of Mr. Arthur Richards that at the Cornwall Tailings Company's plant it is impossible to extract more than 40% of the tin by water-concentration. Similarly, Messrs. Merricks, Crane & Co. have more recently put it on record that, at Botallack, the standard

Cornish dressing-plant recovered no more than one-half. Mr. Richards has also given some startling figures as to the content of tailing discharged into the Red river. The introduction of the chemical assay has disclosed an even greater imperfection than the average critic of Cornish methods had expected.

With tin, as with copper, engineers are engaged in experiments involving centrifugal separation and chemical extraction. Up to the present cassiterite has proved unamenable to oil-flotation, though among those who have devoted attention to this subject there is a general belief that some modification will be discovered before long whereby the process may be adapted to tin. The pioneer of chemical extraction of this metal from ore and tailing is Mr. Arthur Richards, whose work is deservedly attracting the attention of everyone connected with Cornwall or with tin-mining in other countries. We refer elsewhere in this issue to the patents covering his process. He adds a small proportion of common salt, or other chloride or bromide, and coal to the finely-ground material and treats the mixture in a furnace at a bright cherry-red heat. The effect is to volatilize the tin as fume consisting chiefly of stannous chloride. His experiments have shown that practically the whole of the tin as estimated by chemical assay can be removed in this way, for his residues never contain more than half a pound of metallic tin per ton. The cost of the operation is not expected to be greater than that of water-concentration, that is, 4 to 5 shillings per ton of ore. As regards the subsequent treatment of the tin fume, in all probability the electrolytic method will prove the most suitable. The cost of this method does not count in the same way with a high-priced metal like tin as it does with lead or zinc.

Whenever a new proposition for the commercial beneficiation of ores is introduced, it is inevitable that some one will bring forward past instances. Thus we shall probably hear

of the work done by the Metals Volatilization Company in Colorado ten years ago, where a somewhat similar idea was applied to the extraction of copper. Also, the old process for extracting tin from slag by means of calcium chloride may be adduced as an anticipation. From the point of view of the latter process, it may be advisable to mention that a chloride does not react directly upon the tin oxide to produce tin chloride, but that the presence of carbon, or other reducing agent, and silica is necessary. The volatilization takes place according to the formula :



Mr. Richards has this fact in view when he mentions in his specification that the process is only intended for low-grade ores, and that if a high-grade ore or concentrate is to be treated it must be mixed with low-grade ore or have some sand added to it. In its application as described by the inventor the process appears to be a new one, and if judged according to the principle of common knowledge his claim may be held as valid. This article would not be complete if we did not record that other metallurgists in Cornwall are experimenting on chemical methods of extraction. Their investigations have not progressed sufficiently to warrant the publication of details, but we shall hear more of them before long.

Phantom Profits.

Our articles on this subject have been supplemented by discussion and criticism from a number of experienced engineers. We also acknowledge the compliment of re-publication in *The Accountant*, a journal devoted to the expert elucidation of the more technical phases of book-keeping. Thus the effort to focus attention on one of the anomalies of mining finance has not failed. We tender cordial thanks to Messrs. Edward Walker, W. H. Goodchild, W. H. Trewartha-James, W. R. Feldtmann, S. J. Speak, Ernst Lichtenberg, H. S. Denny, and Morton Webber for their

contributions on the subject. To some of them we reply now, to others we shall reply in our November issue. In attacking the problem we hoped, as in other writings, to advance the best interests of the mining profession. Obviously, the very basis of the intelligent appraisal of mines, whether new ones to be offered to the public or current concerns undergoing daily re-valuation, depends upon a correct definition of the terms employed. Until we can agree upon the true meaning of such words as 'cost' and 'profit' we may as well value mines in algebraic symbols and express our appraisals in Esperanto.

Those who have taken part in the discussion all realize the difficulty of fixing the value of a wasting asset and the equal difficulty of capitalizing the chances of a risky form of industry. Mr. Walker suggested the issuance of debentures as a means of distinguishing between the 'positive' and the 'possible' phases of mine valuation, and Mr. Hoover has given us a special article on the proposal. We discuss this part of the subject separately. With Mr. Goodchild we find ourselves partly in disagreement. He denies the statement that the central purpose of mining is to make money, and submits that the central purpose is "to make the maximum of net profit out of a mine, due regard being paid to the rate of realization of the profit." Here we are at cross-purposes. By "making money" is meant, naturally, the making of the most money possible, and this involves the idea of a rate of realization that accomplishes that purpose in the fullest sense. Of course, a mine may 'make money' today at the expense of tomorrow; in other words, it may be exploited extravagantly or its revenue may be distributed without sufficient regard for future necessities. The whole profit yielded by a mine cannot be stated until it is exhausted and abandoned. As regards the terms 'operating cost' and 'operating profit,' we grant that they are convenient, but we have been trying to show how that convenience may be

attained at the sacrifice of truth. It is, truly, convenient to the manager to know the expense per ton incurred locally at the mine and it may be convenient for the directors to segregate such items of cost at the mine from others incurred in London, but it is only misleading to speak of either the cost in London or the cost at the mine as "the cost." Expenditure contracted in London is just as inseparable a part of the business of operating mines as the expense contracted at the mine itself, in Rhodesia or Nicaragua. Here is where the confusion begins. It is time for us to recognize the fact that a director's fees are just as essential to mining by means of company organization as wages to the workman, and that the rent of the London office is just as much a part of the cost of operating a mine as the purchase of powder and fuse for blasting the rock underground.

We appreciate the good work that Mr. Trewartha-James has already done, as chairman of the committee on standardization of mining accounts, and we hope that he will not cease from that good work. We do not agree with him, however, in considering this question as one belonging specially to the accountant rather than to the engineer. On the contrary, we take the view that book-keeping is largely conventional and that the system of mine accounting, as now accepted, reflects the impress placed upon it by the mine operator and company promoter, not the mining engineer. That is why it is often misleading to the shareholder. Accountants make their statements on conventional lines and give certificates of approval according to the system in vogue. For instance, we remember the time when British companies operating in America would debit the expense of shaft-sinking, of cross-cutting, and even of driving levels, to 'capital' account. Just as if in mining the cost of finding and opening up an orebody were not as essential as the expense of plowing and sowing in agriculture. By

such make-believe book-keeping these companies could create a financial position permitting them to pay a six-penny dividend and keep the share-quotation at nearly par long enough to allow the insiders to unload before the inevitable liquidation. No; this is a matter that concerns the mining engineer. It is he that must define what is 'cost' and what is not. It is from him that the untechnical director must get correct ideas on the subject, to be passed to the accountant. After all, the firms of accountants that set the seal of their official approval upon the financial statements of mining companies are engaged by the directors, if not by a particular director, and any undue recalcitrancy or meticulousness on the part of the accountants is likely to lose them a fee that comes easily and regularly. Unfortunately directors do not always act as if they were trustees for the shareholders and it may be to their interest to label as profit a part of the revenue that is only a postponed item of expenditure. In these matters there is a recurrent conflict between the investor, who holds shares for the dividends, and the speculator, who holds them for a rise in the quotation. Most directors, and most wise people, are speculators, but this should not prevent us from recognizing that a large part of the capital subscribed for mining is contributed by persons who 'invest' their money, that is, buy shares for the sake of the income. They face the risk for the sake of the big return, as compared with the ordinary small-paying gilt-edged security. Thus, to come back to our argument, the accountant represents the views of the speculators in control of mining companies, that is, of persons interested in putting a pleasant face on the financial position. This is not the principle guiding the mining engineer. He is, of course, no pessimist or 'knocker.' If he were, he would leave mining and become an undertaker or that depressing person known in America as a 'funeral director.' We must be

cheerful in mining, which is a risky business, requiring the energy that is born of inextinguishable hopefulness. But we must not bury our heads in the sand and refuse to see realities. No legitimate industry can be built safely on the quicksands of make-believe; if mining is not conducted with a sincere recognition of facts, it ceases to be a reasonable venture and becomes a tricky adventure.

Thawing Frozen Gravel.

In our last issue we outlined the conditions under which gold-bearing gravel is found in Alaska and Siberia. We also described how the frozen ground was thawed by wood-fires. This method was slow, disagreeable, and expensive. It was a revival of an ancient method; before Columbus discovered America the miners of central Europe employed the method known as 'fire-setting.' A wood-fire was built close to the face of a mine-working and when the rock had become thoroughly heated it received a douche of water, thrown from a bucket, so as to cause the surface to crack. When thus fractured, it became easy to extract the ore with wedges and hammers. The introduction of powder and dynamite put an end to this ancient practice, which, for example, lingered in the Kongsberg mines of Norway up to 1884. But dynamite was ineffective in gravel cemented by ice, and wood-fires, as we have said, proved unsatisfactory. The smoke and gases liberated called for vigorous ventilation such as was not attainable in workings that usually had only one opening to the outer air. Thereupon one of the pioneers at Dawson hit upon the idea of employing steam for the purpose. In 1898 C. J. Berry noticed that the steam escaping from the exhaust of his engine had thawed a hole in the ground. He picked up the exhaust-pipe, which was a rubber hose, and applied it elsewhere within reach. He ascertained at once that the steam thawed the overburden of ice and moss so as to penetrate this so-called

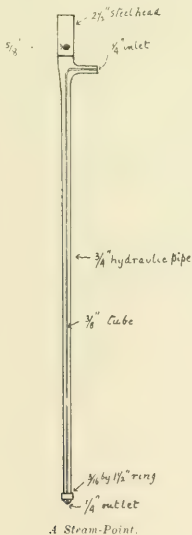
'muck' for the full length of the hose within a few minutes. This excited the men who happened to be watching the experiment. All of them immediately began to devise a scheme for applying the idea. A rifle-barrel was chosen, and a small hole was bored into one side of it so as to admit the steam. Thus the 'steam-point' was invented. In its rudimentary form the steam-point was a short length of iron pipe, pointed at one end, and attached to a length of rubber hose, through which steam passed from a small boiler at the surface. The pointed end was inserted into the frozen ground and driven forward gently by taps from a hammer, as the ground became softened by the steam issuing from the orifice at the point. Later, a solid head was added to the end that received the hammer-blows and a protective ring was welded to the for-

efficiency for a specific purpose. The length of the steam-point ranges from 6 to 16 feet, the usual size being 8 feet. This is driven home so as to make a hole about 6 feet deep, the point being turned by a bar inserted through a hole in the head of the instrument. As the operator hits the head with a hammer, held in one hand, he also turns the point by



means of the bar, held in the other hand. In a 20-ft. deposit, using 'points' 12 feet long, it is possible to thaw 4 to 5 cubic feet per point at each setting. Thus the cost, which was at first as much as 15 pence per cubic yard, was reduced to 8 pence. The efficiency of the method will vary according to the pressure of steam, the length of the tool, the distance between the 'points,' the time allowed for 'sweating' or steaming, and the proportion of ice in the ground. Obviously it is best to arrange the points at such distances apart that their spheres of influence, or areas of sweating, do not overlap. By giving the steam sufficient time to perform its duty, the area thawed is magnified. As the amount of humidity, in the form of ice, increases, so also more steam is required to overcome the latent cold.

When the steam-point was introduced, the extraction of gravel by drift-mining was continued throughout the summer, as well as in winter. Previously the summer had been devoted to the washing of the gravel mined in the winter. Thus operations were accelerated and cheapened. The frozen condition of the ground ceased to be so great an obstacle. A battery of steam-points would soften a face of gold-bearing gravel that would have required a long and laborious succession of wood-fires,



ward end; armoured tubing replaced the ordinary hose, and the body of the instrument itself was made of pipe of special manufacture. Thus the miner evolved a tool of great

with all their concomitant unpleasantness. Further details may prove interesting. They are based upon observations at Dawson, in the Yukon, and Fairbanks, in Alaska. The steam-points may be fed with hot-water only while they are being driven into the ground and when they have been forced for their full length the steam is admitted for 24 to 30 hours. During this sweating period the ground is thawed around each point for a diameter of 2 to 2½ feet. When the gravel has been softened, the points are withdrawn and a gang of miners is put to work with picks and shovels. The gravel is placed in wheelbarrows, which are trundled to the shaft and there emptied into a bucket, to be hoisted by a steam-engine. About one foot deep of bedrock is removed with the six or seven feet of rich gravel, for the gold is found lying in the cracks and crevices of the bedrock, which, however, is so decomposed that it can be broken as readily as the overlying gravel. The typical stope in a northern drift mine is a low cavernous opening, with the air of a cold-storage chamber. Along one side, in the layer of fine gold-bearing sediment, is a series of steam-points, only their heads visible, and with nothing to indicate the process at work, for all leakage of steam is carefully prevented. Not only does a leak mean a waste of energy but the heating of the air underground by escaping steam is apt to thaw the roof and precipitate a fall of rock. In walking through workings where nobody is at work, the visitor will hear the dropping of gravel loosened through the warming of the air by the bodies of the workmen and he may occasionally receive a tap on his shoulder to remind him that mining is dangerous as well as profitable. However, serious accidents are rare, owing to the recognition of the danger and the care to avoid it. And nowhere is the human animal so superb a machine for excavating material as in the drift mines of Alaska and the Yukon. The labourers are well paid and well fed, and are led by a

man who is picked for his strength and willingness; he leads the six or eight members of a gang as they make a procession with their wheelbarrows to the shaft and return to the face to break a fresh supply. The cold air, the good wages, and the abundant food unite in making them splendid workers. Under such conditions the brutality of manual labour is hidden by the exhibition of human energy exerted to useful purpose.

Debentures in Mining.

As a sequel to the series of articles on 'Phantom Profits,' and as a practical solution of at least one of the problems arising therefrom, we publish in this issue a suggestion from Mr. Herbert C. Hoover. We do this with keen pleasure. In the domain of practical mining finance, no one holds a more assured position. He does not write academically, but from a background of successful experience. Even the proposal submitted by him, as a method of overcoming some of the difficulties inherent in the valuation of so valuable an asset as a mine, has been applied to one of the enterprises with which he is connected, namely, the Kyshtim Corporation. In that instance it was applied successfully, hence the proposal is placed before us not merely as a contribution to discussion but as a chapter from current financial practice. The scheme is nothing more or less than the issuance of debentures, in lieu of shares, to cover the assured profit in a mine, leaving the prospective value to be expressed in shares. By redemption of the debentures the capital would be amortized automatically, leaving the shares to represent either the enhancement of value due to new discoveries or the cheerful exaggeration incidental to all forms of scrip speculation. Of course, the foundation of such a scheme is a uniform interpretation of the term 'profit assured.' As to that, it can be said confidently that the growth of experience in mining and the increase of knowledge on the

part of mining engineers have rendered it much more easy than heretofore to arrive at a general understanding in regard to the factors defining the reasonable certainties in a mine. Opinions may still differ in particular and complex cases, but the line of reasoning on such matters is now sufficiently established to permit of the use of the term 'profit assured' as one that signifies about the same thing to men of similarly wide experience and similarly sound views. Obviously, the debenture proposal would solve several problems. For instance, the amortization of capital and the escape from taxes such as are now imposed on so-called profits that are no profits at all. Many mines fail to return their capital, let alone any interest on it; yet every dividend, which is in part, if not wholly, a return of capital, is taxed in England as income to the shareholder. He may lose 50% of his capital, and receive no interest whatever, yet if it comes to him in the shape of two dividends of 25% he pays the Exchequer a tax upon it as if it were current income. Similarly in the Transvaal a so-called profit is taxed when only 80% of it is even current profit, while, in the end, it may be proved that even of the 80% a large fraction is merely a return of capital. For these anomalies the operators in mines are to blame. They have been only too willing to exaggerate the profit in order to enhance the share quotation. It suited them to state their accounts in optimistically misleading terms if thereby the market valuation of the mine could be kited. Most of the groups and syndicates engaged in the control and flotation of mines make their money by selling to the public when that public is excited and by buying from that public when it is scared. Hence an intermediate stage of book-keeping whereby the return of capital is glorified to a dividend and an item of unsegregated cost is entered as a profit. In these and other matters pertaining to the application of science to industry, it is impera-

tive that we should break away from make-believe and face the facts frankly. The issuance of debentures tends that way.

Journalism.

On September 10, 1912, *The Times* celebrated its 40,000th daily issue by publishing a history of printing and a record of the growth of the British newspaper. The occasion was worthily celebrated, and elicited the friendly appreciation of the world's Press, to which *The Times* has so long been an example, if not an ideal. As Englishmen we are proud of it. We are also glad that it escaped the yellow blight that threatened recently to make it more Daily-Mail every day. We hope it may long remain a British institution and the exponent of dignified, informing, and effective journalism.

The leader of all newspapers was founded by John Walter on January 1, 1785, appearing first as *The Daily Universal Register*, but changing its name to *The Times* exactly three years later, on January 1, 1788, since which date no less than 40,000 numbers have been issued from the same office in Printing House Square. The founder had been bankrupted by underwriting ships during the American War of Independence and had turned his energies to the printing business in order to gain a livelihood for his family. A man of honour and possessed of the confidence of his creditors, he obtained ample financial support. He had become fascinated by the idea of holographic printing, that is, printing from whole words or syllables, instead of individual letters. Reducing the number of logotypes to 1500, he used this method for three or four years, before his compositors and the trade generally compelled him to abandon his pet scheme. He was succeeded by other Walters, so that the name of the family has been continuously associated with the paper that he founded. Even today, with the influx of strange personalities and new capital into *The Times* office, it has

on its staff more than one of the name of Walter. However, newspapers are not made by their proprietors, but by their editors. It was John Delane that lifted *The Times* to an unassailable primacy in journalism, and it is Delane's successors that have given the Walter family the support of a mental power and intellectual honesty requisite for so big a task.

In the story of the British newspapers it is related that Sir Robert L'Estrange, the Surveyor of the Presses to Charles II., said: "A public mercury [or newspaper] should never have my vote, because I think it makes the multitude too familiar with the actions and counsels of their superiors, and gives them not only an itch, but a kind of colourable right and license to be meddling with the Government." We are told that Sir Robert was the first Tory. This appears likely. He spoke as the quintessence of a reactionary. But, thank the Lord, his theory of Government has been smashed to smithereens. The Royal Prerogative in the publication of news has gone, the Parliamentary ban on the reporting of legislative proceedings likewise went long ago, and with them the idea that mystery was inherent in Government and secrecy in the progress of industry. It still survives among the directors of Rhodesian companies and in the office at Rio Tinto, but it is an excavated anachronism that will soon be as humorously out-of-date as the top-lofty tone adopted by L'Estrange in the days of Stuart misgovernment. Sir Robert ran a newspaper himself, hence a part of his unwillingness "to give his vote for a mercury." The administrators of companies who regard their shareholders as an ignorant mob, to whom no accounting is due, or as outsiders beyond the privilege of information concerning the mystery of company management, are belated survivors of a dark age. The present editor of *The Times* says that "little by little 'the multitude' asserted and won its rights, and among them was the right to know the news." Thus also

little by little the unnoticed shareholders have insisted on their rights also, more particularly the right to have the news from the mine promptly and frankly. That is one of the lessons we draw from the 40,000th number of *The Times*.

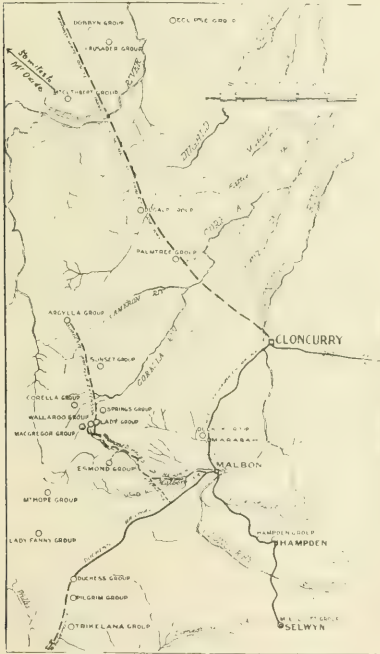
Another remains: Matthew Arnold said that literature was a criticism of life. We venture to say that journalism is a criticism of daily life, of current events, of the flux of phenomena amid which we live. It is the function of the newspaper not only to collect news but to guide public opinion; to aid the very mob despised by the cavalier L'Estrange to arrive at a just appreciation of current events. Thus the editor becomes a public critic and assumes duties that he cannot discard at will. When he shirks the duty of criticism, because it affects friends or irritates enemies, if he happens to have many of the first or a few of the latter, then he is renegade to his trust. For editors take themselves seriously, as well as humorously, and journalism has become something more than a record of haphazard happenings. This is true particularly of that branch of it devoted to technology. We are proud of the growth of technical journalism as applied to mining engineering. It has broken away from a sinister environment and is more nearly independent than the daily Press. The three or four leading mining journals in the English language have proved that they can devote their critical abilities to mining finance without being tied to special interests and that they can furnish an effective medium for advertising without becoming subservient to the manufacturers of machinery. That is something that even the supplements of *The Times* have not escaped. On that independence is based the very manhood of our craft. To be just to all but independent of each, to be fair to all but servile to none, is the aim of the modern newspaper, whether it be a Titan like *The Times* or a minnow like *The Mining Magazine*.

SPECIAL CORRESPONDENCE

News from our own Correspondents at the principal mining centres

MELBOURNE.

In North Queensland the copper-mining industry is making substantial progress. At the Mount Elliott mine, the developments at the bottom level have disclosed a large lense of ore. At present it is not at all clear whether this is not a flat lode, but the company has safeguarded its resources by the purchase of



The Cloncurry Copper District, North Queensland.

the Hampden Consols and other properties in the district. W. H. Corbould, the general manager, is now on his way to London, and seeing that the shares have jumped up to over £7 each much curiosity exists as to the reason of his mission. The expectation is that he will push his scheme for making the company the centre of the Cloncurry copper region.

The Hampden mine, not far away, has begun smelting, but so far though the smelter has been producing plenty of matte the converting has not been satisfactory, as the kaolin ore in the north end of the Hampden mine has proved difficult to treat. Still that is a minor and easily removable trouble. Capital is flowing to the Mount Oxide mine and to the Mount Cuthbert mine. The Macgregor group of mines is to be acquired by the Hampden Cloncurry company. It seems clear that at no distant date an appreciable quantity of copper will be forthcoming from the extensive region of which Cloncurry is the centre. It is gratifying to know also that the Chillagoe company after a year of downright stress has been improving its position and that the finances, which looked rather blue six months ago, are now £50,000 stronger. In addition a good strike of ore in the Einasleigh mine has given more confidence to shareholders who regretted the way in which the Zillmantion operations had ended in a loss.

The Mining Industry of Australia is at the present time occupied more with the development of old fields than with prospecting for new deposits. This position of affairs is due to economic conditions. I have on several occasions alluded to these conditions and I need not dwell upon them now, save to say that a gradual revolution is taking place in public sentiment. We have to admit plainly that the community has been 'going the pace.' For the past financial year the revenues of both the Commonwealth and the individual States have been on a magnificent scale for so small a community, but we have been spending the income royally. Moreover we have spent the money which the Federal parliament forced as a loan, not bearing interest, from the banks, when it was decided that the state should issue paper money in place of the former bank notes. The outlook for the season has been unsatisfactory owing to the lateness of the winter and to the patchy character of the rainfall. Imports have been coming too freely and gold has had to be sent away in large quantities to meet public and private bills. Further, a large drain of capital has taken place owing to the realization of property and securities by people who held interests in Australia and decided to sell when the

drastic nature of labour legislation, so far as absentees were concerned, was fully appreciated by them. Now the banks have raised the rates for which they will take long-term deposits to 4%, and there is some talk of a further advance to 5%. This means a corresponding rise of the rates for loans. Such rates mean a restriction of enterprise until money has again accumulated and the imports have been brought down to a proper level. The immediate effect must be to restrict employment in the cities and to cause labour which has drifted thither from the mines to return or to go into new country to prospect. It has always been during a period of stringency, such as now seems to be ahead, that the important mineral discoveries have been made. Those interested in the mining industry are therefore not altogether regretful that some check is to be imposed on public and private expenditure, resulting in labour becoming available for mining.

Gold Production.—The worst feature of the position is that the gold yield of all the states is still on the decline. In Western Australia this arises from the lower grade of ore that is being won at depth and to the inability of capitalists to secure the cheap labour which would make it possible to exploit the low-grade deposits. The same thing can be said of Victoria and of North Queensland. In Victoria the Miners' Wages Board not long since gave an increase in the pay of the worker. The average rate ranged from 7s. 6d. to 8s. per shift of 8 hours, except in the alluvial areas where up to 10s. was paid where contract work is done when wash is being stoped from the old river beds. As a whole the mining industry in Victoria does not now pay, and there are signs that the increase in the rate of wage is driving investors out of the industry. They are prepared to pay calls if they see a return ahead, but they are not inclined to do this when they know that everything will be taken by the worker. In Queensland the complaint is the same: the short supply of miners and the high wage. At Broken Hill, where the average wage in the South mine for miners on contract work for the last half year was 16s. 2d. per shift of 8 hours, there are still plenty of openings for competent workers. At Charters Towers and at Gympie no developments of any importance have occurred of late, and the drift of capital is rather away from those fields than to them.

Broken Hill.—As contrasted with the depressed state of the gold-mining industry, things are booming at Broken Hill. This

arises from the high price of lead and zinc. The reports that have been issued by the North and the South companies show how those ventures are justifying their position as leading producers in the Barrier range. Not only have profits been on such a scale as to enable dividends of well above the paid-up price of shares to be disbursed during the year, but in the North mine developments at depth have been eminently satisfactory. The grade of ore there, in a part of the lode varying from 70 to over 100 ft. in width, has increased from 15'4 to 18% lead. In the South mine developments at depth are satisfactory, although the grade of ore at that end of the range is not so high in lead by 1 to 2 units as at the north end. The Broken Hill Proprietary on the other hand issued a disappointing report, profits being at £188,000 for the past half-year, as compared with £204,800 for the preceding six months. This fall, however, arises from trouble with mechanical appliances and stoppages at Christmas and Easter. All the zinc-tailing works are doing splendidly, but it has to be recollected in their case as well as in those of the other mines that the drain upon the accumulated dumps is very great and that the time will soon come when only the current output of the mines can provide zinc concentrate. Scientific work in connection with the treatment of the tailing is being steadily advanced. In this connection the next development is sure to be the application of the flotation process on a more extended scale to the treatment of low-grade copper ores. The Zinc Corporation is credited with being a possible purchaser of zinc or copper properties amenable to flotation processes.

In Tasmania the Mount Lyell mine has now succeeded in bringing itself up to its old strength after the strike, but some restless spirits there threaten trouble now and again. The rumour that the board might float its superphosphate business as a separate organization has not so far materialized. The company is seeking to turn to account its Lyell Comstock leases, and reports indicate that the company got a bargain in them. In the Rosebery district, nothing of importance has yet occurred in connection with the work at the Tasmanian copper mine, where the bisulphite process is being given a trial. There was some talk of this process being applied at the Hercules mine, but the agitation in which Bowes Kelly and Lindsay Tulloch, two of the Mount Lyell directors, are participants, to secure a change in the directorate of that company, may mean that an amalgamation of the Her-

cules and the Primrose mines with the Zeehan smelters will be completed. German capital may be forthcoming to treat the ore of these mines by means of the Oker process, well known in Germany. The change in the directorate will not be effected without a fight, because there are some who contend that better work can be done by the flotation process or the bisulphite process.

JOHANNESBURG.

Extension of the Rand.— Mr. David Draper, to whose efforts in the past our local geology owes so much, has been expressing the opinion recently that it is hopeless to look

other difficulties, that not a single producing mine yet exists along this proved extension. A similar state of affairs exists along the few miles of extension proved beyond Randfontein. Notwithstanding the assurance with which Dr. Voskule announced his discovery of the Main Reef near Klerksdorp, it turned out a complete fiasco and added nothing even to our knowledge of the Klerksdorp reefs, or any positive indication of where to look for the Main Reef series in that district. Then again the Heidelberg goldfield is appreciated less today than it was twenty years ago, owing to the general poverty of the banket and the lack of any important new discovery.



BROKEN HILL BLOCK 10 MILL, now being re-constructed.

for any extension of the Rand goldfield which, he asserts, is nothing more than a local enrichment. The expression of such views has naturally given rise to controversy, but it cannot be denied that attempts to prove the extension of the Main Reef series during the last twenty years have been attended with a remarkable lack of success. All that can be claimed is the connecting of the outcropping reef on the Rand Klipfontein in the Far East Rand, with the Heidelberg goldfield in the neighbourhood of the Nigel; but so low is the grade for the most part along this outcrop, and so beset with

Even in the Orange Free State, around Parys, where George S. Corstorphine claimed to have discovered outcrops of every Rand reef except the Main Reef series, his prospecting operations added little to our knowledge; they failed entirely to disclose the Main Reef series and did not uncover a single continuous profitable lode of any description. A. R. Sawyer has also spent considerable capital and time in looking for an extension of the Rand in the Orange Free State farther to the east of Mr. Corstorphine's scene of operations. Judging from the results of the work accomplished, and

the disappointing predictions made in connection with the last half-dozen boreholes, the position of the Main Reef series is nearly as much an enigma as it was before these prospecting operations started. All the work done has been in the unproductive beds of the Lower Witwatersrand. The boreholes, 14 or 15 in number, seem to indicate that it is likely to continue economically valueless.

While a good deal of what Mr. Draper states is undoubtedly correct, dim possibilities of extensions do exist, but so far in the Transvaal only a few scattered patches of the lower unproductive division have been discovered. Some of these patches are over 200 miles from the nearest known outcrop of the Main Reef series on the Rand, leaving open the possibility of an intervening basin of Witwatersrand beds; but the older rocks being concealed from view by newer unconformable measures, the task of finding any hidden basin is not easy, and at present seems well nigh impossible. It must therefore be concluded that, in the state of our present geological knowledge, the discovery of a New Rand is improbable. It would be far easier to trace the extension of the Rand beyond Randfontein to Klerksdorp, but the Main Reef probably lies so deep and is hidden by such a thickness of dolomite in that direction that speculators seem indisposed to undertake the task.

Crown Mines.—One prominent feature of the past month has been the change at the Crown Mines from old to new methods. It has involved a lesser output, with the usual effect on working costs, but the drawbacks have proved less than was anticipated. Three years ago, when the amalgamation scheme was adopted, an elaborate equipment and costly development scheme was outlined; even this has been enlarged until, on June 30 last, no less than £1,500,000 had been spent. In order to place the finances of the company on a proper footing, an issue of £1,000,000 in 5% first mortgage debentures has just been made. The original scheme was a pretentious one, the main object being to make the amalgamation thorough, and not, as in the case of most other Rand so-called amalgamations, one in appearance only. Once started, however, it was deemed necessary to add to the milling capacity by no less than 80,000 tons per month, and this again involved greater expenditure both above and below ground than originally intended. The first estimates were found much below the actual capital required, even to carry out the original scheme. The upshot was that the ore reserves had to be more than

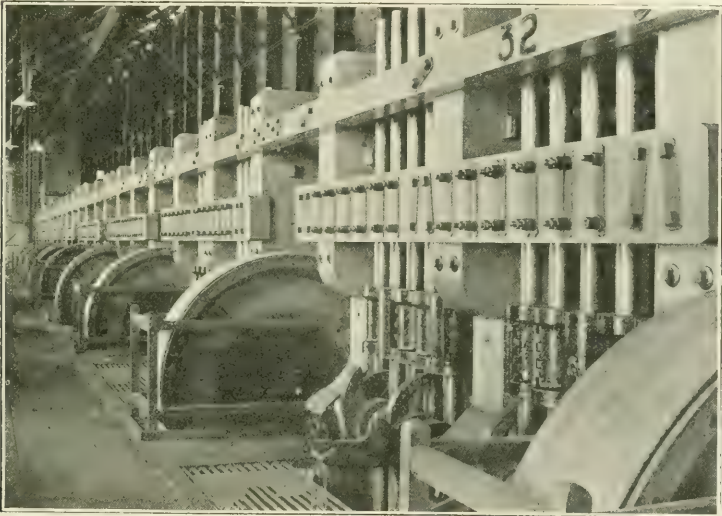
doubled (only 4 out of 11 shafts are at present in use and the number will soon be reduced to two), so that when everything is completed the Crown Mines will probably represent an amalgamated enterprise in every sense of the word. The two shafts will be fed by a main level, 15 ft. wide by 9 ft. high, extending through the length of the whole property, and fitted with up-to-date electrical traction, conveying 80 tons of ore to the shafts every trip. The developed ore at date represents approximately a four years' supply, and at least a profit of £5,000,000. Should the ore maintain its yield in depth beyond the dike running east and west through the property, the life of the Crown Mines as at present constituted must necessarily be a long one, and may be regarded as probably equal to that of the goldfield as a whole. Working costs at the Crown Mines are expected to be an example to the rest of the Rand, once all the improvements come into smooth operation, but so far, during the transition stage, as the last three years have been officially termed, many of the shareholders have been disappointed because the working cost did not show the diminution expected nor allow the dividends forecasted at time of amalgamation.

Oil Shale.—There appears to have been some attention attracted in London of late to the occurrence of oil-shale in the Transvaal, as indicated by the flotation of the Transvaal Oil-Shale Syndicate with a capital of £60,000, for the purpose of prospecting on the farm Mooifontein in the district of Ermelo. There can be no possible doubt about the existence of oil-shale in the Eastern Transvaal, but the misfortune is that the formation usually does not cover sufficiently large and continuous areas to justify the erection of a large treatment plant, and where the shale is extensive it is generally too thin to be exploited profitably. This particular deposit on Mooifontein was abandoned by the South African Prospectors Co. several years ago for the reason just cited, while more recent prospecting operations have decreased rather than increased the probable area over which it may be expected to extend. In the Transvaal these patches of shale are almost invariably accompanied by a coal seam. This is the position at Mooifontein, but hopes are entertained of finding oil in the thick bed of shale immediately overlying the Dwyka conglomerate at the base of the coal measures. The best bed of oil-shale at Mooifontein seems to have fallen from a yield of 40 gallons per ton, at the outcrop, to less than 30 gal., a yield which in the

Transvaal would not justify the erection of a plant for such a small area as that already proved. In the Wakkerstroom district, the yield runs from 60 to 90 gal. per ton, but the shale is exceedingly thin and prospecting operations do not seem to show any increase in thickness. Taken altogether, the prospects of the establishment of an oil-shale industry here cannot be deemed encouraging, notwithstanding the fact that the whole of the finished products would be readily consumed on the Rand.

27s. 9d.; August, 26s. 9d. The marked increase during the last three months seems due to causes beyond control, such as the collapse of sand-filling and labour shortage, but the figures prove how difficult it is in practice to reduce the working cost even when the impoverishment of ore in depth makes an imperative demand for it.

Diamond Mining.—The figures published in regard to the diamond production of South Africa during the first six months of this year confirm all that has been said with regard to



THE BRAKPAN MILL. Supplied by Fraser & Chalmers.

Geldenhuis Deep.—The chequered history of the Geldenhuis Deep forms an interesting instance of the trials of mine management. This property was recently amalgamated with the outcrop mine known as the Geldenhuis Estate and the Jumpers Deep, but the exhaustion of the ore in the old Geldenhuis Estate left the Geldenhuis Deep with stopes of a falling grade. Attempts were made to reduce the working cost by concentration of the underground operations, and as a last resource the management was changed. During the last seven months the figures relating to the working cost have been as follows: February, 23s. 5d. per ton; March, 24s.; April, 24s. 4d.; May, 25s. 8d.; June, 26s. 3d.; July,

the increasing demand and better prices obtained for all descriptions of stones from the mines, while diamonds obtained from alluvial diggings appear, on the other hand, to have declined in price. Kimberley retains the leading position for the value of diamonds produced, the mines in that district having washed 3,149,670 loads (16 cu. ft.) in the half-year, obtaining 1,031,598 carats, valued at £2,528,977, which was more than half the £4,541,451 value of diamonds obtained from all sources for the whole of South Africa. The Premier, which is the only regularly producing diamond mine in the Transvaal, washed 4,405,136 loads, and produced 939,629 carats, but the value was only £845,648, or less than one-third of that

value yielded at Kimberley alone. There was a marked diminution in the amount of work done at the mines in the Orange Free State, where 9 mines only washed 2,354,131 loads for 330,191 carats, but the total value, £747,111, closely approached that of the Transvaal, where the weight of the output was nearly three times greater. The average value of the stones was: Kimberley, 49s.; Orange Free State, 45s. 3d.; Transvaal, 18s. per carat. For the whole of 1911 prices averaged 46s. 2d. at Kimberley, 40s. 4d. in Orange Free State, and 15s. 10d. per carat in the Transvaal.

Owing to the recent discovery of diamantiferous gravel near Bloemhof, the Transvaal headed the river and alluvial production in South Africa with 42,524 carats, valued at £191,496, against Cape Colony, 41,285 carats, value £217,094, and the Orange Free State, 488 carats only, value £2304. The total production of alluvial and river stones for the whole of South Africa during the first half of this year being 84,299 carats, valued at £410,894.

There has been considerable activity of late in the diamond industry, but beyond two small mines in the Orange Free State it is many years since a new mine was discovered. Even the Roberts Victor has fallen on evil days, while the Voorspoed has proved unprofitable, and is now absorbed by De Beers. In the Pretoria district, where no less than 15 worthless indications exist for one solid producer, there has been a repetition of the usual activity in taking up old and abandoned properties. At the Montrose and Schuller properties, spasmodic, though useless, efforts have been continued throughout the year. One enterprising speculator has annexed a deposit called by the Geological Survey of the Transvaal "volcanic breccia" and claims to have established the existence of diamonds therein, but although it has been carefully examined by engineers on behalf of several of the leading Rand groups, no one seems inclined to attach much value to the deposit. Other similar deposits are being carefully examined and again acquired on prospecting options, but fortunately the experts can generally tell at a glance the importance to be attached to these indications, and as any promising diamond mine would be snapped up locally there is no likelihood of anything good being brought to London for flotation.

Bubola Process.—Some experiments have recently been made by the Mines Trials Committee with the Bubola patented process of treating sand. The use of electricity is involved. The experiments are not complete. So far the new process has met with a fair

amount of success, the treatment of transferred sand being completed in the comparatively short period of 24 hours, thus leading to increased economy. In the matter of treating sand there may not appear much room for increasing the percentage of extraction, but should the Committee decide to go on with the experiments, the results will be awaited with interest. There seems to be some doubt as to whether the Mines Trials Committee will continue in existence much longer, for despite the need that exists for such an organization to take in hand experiments in regard to new processes for the benefit of the whole Rand, it scarcely seems fair that those who decline to contribute their share to the cost should derive equal benefit from the work performed.

KALGOORLIE.

Southern Cross.—Fraser's mine, which was originally taken up as long ago as 1889, and sold, in 1901, to the British & Foreign Development Syndicate for £12,500, is at present for sale. The old company treated 245,000 tons for £457,000. The whole of this ore was mined from above the 300-ft. level, the deepest in the mine. Since the syndicate acquired the property tributors have taken out, also above 300 ft., 80,600 tons for a return of about £1 per ton, inclusive of gold from the old tailing. Not a foot of sinking has been done by the syndicate in its 12 years of tenancy. Since January pumping has ceased and the water allowed to rise, and the mill has been closed down. Tributors were told they could work free of royalty, the syndicate's manager apparently believing the mine was depleted. That he was wrong is proved by the fact that men have continued to work above 100 ft., and, during July, four parties numbering 8 men, raised 324 tons for a return of £1115 or 68s. 10d. per ton, exclusive of gold in residue. The ore-shoot is stopped out over a distance of 4000 ft. with two short breaks. Four years ago the property was inspected by Harry D. Woodward, Government Geologist, who strongly recommended putting down a dozen bores at intervals of 100 ft.; but nothing was done, and nothing is known of the lode at depth.

Richard Hamilton, the manager of the Great Boulder Proprietary company, has paid three visits since June to the Great Victoria, 30 miles south of Southern Cross. This is probably the biggest and most consistent low-grade gold mine in Australia. The present owners, Messrs. Delbidge and McDonell, two working miners, have sunk a shaft to 320 ft. At the 100-ft. level the lode has been exposed for a

length of 300 ft., and three cross-cuts, each 100 ft. long, have failed to reach the hanging wall. At 300 ft. the shaft cut the foot-wall of the lode, and a cross-cut was then extended for 50 ft., and a winze was sunk to 37 ft. From this development 7500 tons was milled for an average of 12s. per ton, leaving 16s. 6d. per ton in the residue. As the water then failed, the Government granted the owners a subsidy of £1000 to sink the winze and continue the cross-cut to try and cut a fresh supply. In continuing the cross-cut, the ore improved, yielding assays as high as 255s. per ton, the last 22 ft. (from 103 to 125 ft.) averaging 51s. per ton. The hanging wall of the lode was even then not reached. Since Mr. Hamilton took an option on the mine at the price of £50,000, no news has leaked out regarding developments, though work is still proceeding. The mine is equipped with a 10-stamp mill, but has always been hampered by shortage of water.

The Black Range mine is one of the few good little mines picked up by Hans Irving of Melbourne. He floated it for £6750 in December 1904; during 1905 it paid £8438 in dividends, besides accumulating £10,000 of a reserve fund. In June 1906 the shareholders received 10 shares for 1, and 5000 more were issued to buy the 20-stamp mill from Fraser's Central. Up to date the mine has produced £594,454 from 148,803 tons and paid £225,590 in dividends. For the first seven months of the year the output has been 15,549 tons for a return of £53,242, and a profit of £21,050. Regular monthly dividends of 9d. per share, or £2718. 10s., have been paid for years. The deepest workings are at 800 ft. vertical, where the ore is as rich as ever. The lode is flat, dipping west at an angle of 35°. This mine went begging for some time before Mr. Irvine acquired it; for, the lode being flat, all the experts were afraid it would not persist.

Kurnalpi.—There is nothing fresh to say concerning Kurnalpi, as the usual red-tape is obstructing work. Some 75 leases, aggregating 1500 acres, have been applied for, and fees paid, but until the ground is surveyed, and the leases granted by the Minister of Mines, the ground is still Crown Land. As the Minister usually takes three months to grant leases after the Warden has recommended them, six months is usually taken in empty formalities.

Labour.—Nothing is yet settled regarding the wages question. The present agreement expires in a month, and 30 days' notice has to be given before the agreement can be annulled. The Chamber of Mines has issued an

ultimatum, but the drift of it has not transpired, although it is rumoured that shovellers and trammers are offered 8d. advance per shift. A joint meeting of the Chamber and the Unions will be held on September 1 to discuss the question, and the result will be cabled to London.

[Cabled information received in London on September 9 indicates that the deadlock continues. The mine-owners refused the demand for a rise of one shilling per shift for unskilled labour. The Unions are threatening a strike, but so far no action has been taken. — EDITOR].

TORONTO.

Porcupine.—Very little information is allowed to transpire as to the output of the mills now in operation. The Hollinger is credited with a production approximately in value \$200,000 during August, and the Dome's output for the first week of September is reported at \$43,000. The Vipond at latest accounts was still operating under difficulties caused by the shortage of water and defects in the machinery. Some alterations in the plant of the McIntyre have been found necessary on account of a radical change in the character of the ore in depth. On the 300-ft. level the ore becomes rich in sulphides with fine gold associated with it, rendering it desirable to adopt the cyanide process in place of the amalgamating system used for the free-milling ore found at the upper levels. The nature of the plant to be installed at the McEnaney will depend on whether a similar change in the character of its ore is found to occur at 400 ft. This mine has \$75,000 worth of ore now on the dump and is breaking ore assaying \$50 per ton out at the 300-ft. level. The action of the Crown Chartered directors in attempting to dispose of the Davidson claim, the only holding of the company of proved value, is strongly opposed by many of the shareholders, and an action has been brought to prevent the completion of the sale. At the Hughes the main vein, which had crossed the shaft, has been picked up on the 150-ft. level, where it has widened to 8 ft. and shows improvement in grade. The shaft is being put down to 200 ft. and it is planned to erect a 10-stamp mill before winter. The Dome Lake mill is to have 10 stamps and two tubes and will use the amalgamating process entirely at the start, with provision for the addition of a cyanide plant, should it be found necessary. A change has been made in the management, M. G. Talcott, succeeding J. F. McKenzie as man-

ager. A promising vein has been uncovered on the Krist property (adjoining the McEnaney), in which British capital is interested. A shaft has been put down 50 ft. and a contract closed for sinking 50 ft. deeper. A good vein carrying free gold has been found in the Jupiter by cross-cutting at the 300-ft. level. The Apex mine, which shut-down last spring, has been re-opened with Peter Kirkegaard in charge. The Schumacher, on which about \$10,000 had been spent in development, has been flooded by water from Pearl lake. The Patricia, adjoining the Hughes, has uncovered a vein 6 ft. wide, believed to be a continuation of the Hughes vein. The Three Nations is adding a 4-drill Rand compressor. The Swastika has the framework of its 10-stamp mill completed, and it is expected that it will be in operation by the end of October. The management claims to have enough ore above the 300-ft. level to run the mill for 18 months. The Lucky Cross, in the Swastika district, has started work on the foundations of its 10-stamp mill. An arbitration board has been appointed under the Lemieux Act to settle the dispute over wages between five of the operating mines and their employees.

Cobalt.—While mining stocks generally are inactive on account of the apathy of the public and the more attractive opportunities for speculation presented by the real estate market, interest has mainly centred in the Cobalt issues by reason of the resumption of operations on many properties that had been closed-down. There has been considerable buying of some of these low-priced stocks, which have shown slight advances. La Rose has been on the down-grade for some time and is now selling in the neighbourhood of \$2.60 owing to a widespread belief that the mine has been bottomed and that the present dividend rate will not be maintained. The regular quarterly dividend of $2\frac{1}{2}\%$ has been declared. The Nipissing has also made its usual returns of 5% regular dividend and $2\frac{1}{2}\%$ bonus, the accompanying statement showing \$1,379,864 in cash, bullion, and ore in hand. The company has expended \$225,000 from its earnings this year in the construction of its low-grade mill, which is expected to start operations in November. New orebodies found on veins 73 and 74, ranging between 3 and 4 in. wide, will average about 2000 oz. silver per ton, and a new find on vein 63 runs about 800 oz. The Timiskaming has attained the greatest depth in the district, and is now cross-cutting at 650 ft. to tap No. 3 vein, which has yielded well on the 575-ft. level. This mine

recently shipped 30 tons of ore to the smelter at Denver, and, in addition to the returns for the silver, received payment at the rate of \$5 per ton for the copper content of the ore. This is the first payment ever received for copper in Cobalt ore. The Beaver is another company whose experience in mining at depth has encouraged the resumption of operations on properties that had been closed-down before their possibilities at a lower level had been tested. It is working in good ore in the diabase underlying the Keewatin at the 530-ft. level and will go deeper. The Beaver has formally taken over the Donaldson property in the Elk Lake District, for which extensive operations are planned and a large plant has been ordered. The royalties payable by the Cobalt Townsite have been reduced from 25% of the gross earnings to 15% on the net earnings. The Silver Queen, an old-time dividend-payer has been leased by the Cobalt Aladdin Co., in which British capital is invested, and is being unwatered. The Waldman has been taken over on option by Col. W. L. Malcolmson, of London, on behalf of an English syndicate. A statement by the Trethewey for the first seven months of the present year gives the production at 389,000 oz., valued at \$207,605, yielding a profit of \$101,294. The Miller Lake-O'Brien in the Montreal River District has opened up a rich ore shoot on the 250-ft. level. A winze sunk 40-ft. below that level is in good ore all the way. The mine has this year shipped two carloads of ore, nothing of a lower grade than 4000 oz. being sent out owing to the cost of transport. As soon as the railway reaches Elk Lake, the Moose Horn mine will ship high-grade ore of which it has a quantity sacked in readiness. A Toronto syndicate represented by A. P. Seymour, formerly manager of the Cobalt Lake, has bought the claims at Hubert lake held by Dr. C. W. Haentschel and Samuel Tonque for \$100,000.

Baffin's Land.—In July last an expedition organized by A. W. Scott, usually known as Lucky Scott, of Toronto, left St. John's, Newfoundland, in the steamer *Neptune*, to prospect for gold and other minerals in Baffin's Land within the Arctic circle. Reports of the occurrence of gold, coal, iron ore, and other deposits had been brought by Capt. Robert S. Janes, who had been on a former expedition, and who acted as guide to the party. The search, however, proved entirely unsuccessful and the adventurers have returned. They picked up at sea the members of another exploration party led by Capt. G.

Munn, who had started out with the same object a short² time previously from Sydney, N.S., but whose vessel, the steamer *Algerine*, was caught and crushed by the ice.

SAN FRANCISCO.

Conditions in Mexico continue much disturbed and recent newspaper reports have been extremely sensational. The El Tigre mine, in Sonora, was held for some time by the Federal forces, but was captured by the rebels last week. The mine plant was not harmed nor were the Americans in charge, but

13,152,522 lb., which has only been exceeded in one previous month, December 1911. The share-market, usually sensitive, has not responded to the newspaper reports and it is evident that inside information must be less pessimistic than the dispatches. On the other hand, it is unquestionable that many properties have closed down indefinitely as a result of disturbed conditions, which bear more hardly on the smaller enterprises and those farthest from the international boundary.

Oil Engines.—Use of internal combustion engines throughout the United States, and



A MINERS' BOARDING-HOUSE.

21½ bars of bullion were looted. It now appears that at the time the mine was captured a Federal force that had been sent to relieve it was in camp a few miles away. It was also reported that Walter Douglas, son of James Douglas, had been captured by rebels near Nacozari, where he had gone in an attempt to rescue American women and children. Mr. Douglas escaped, but was unsuccessful in his attempted rescue. In contrast with such dramatic reports comes the August record of the Montezuma mine (of the Phelps-Dodge company), which produced 3,229,389 lb. copper. The smelter at Douglas also made a record of 11,270,263 lb. The total output of the Phelps-Dodge properties for the month was

more particularly of those types using refined oil products for fuel, has been increasing so tremendously that a serious shortage of gasoline (or petrol) has resulted. This shortage is growing more acute every day. The largest contributing factor is undoubtedly the enormous increase in the use of the automobile. California has issued licenses to over 80,000 automobiles, of which over 50,000 are still in daily use. The number of machines per capita is exceeded only by the state of New York. The daily increase in the number of automobiles in this state is now in excess of 100 cars. A simple calculation brings out the enormous demand made by the almost universal use of the motor-car upon the world's production

of gasoline. The mileage per gallon of gasoline varies from about 6 for the heaviest and highest powered cars, to from 25 to 28 for the lightest low-powered cars, the general average being about 12 miles per gallon of gasoline. The average daily mileage for pleasure vehicles may be taken at about 25, which would make the daily average consumption of gasoline for automobiles in the state of California alone no less than 100,000 gal., based upon the assumption that there are 50,000 cars in daily use. This amount is increasing at the rate of over 200 gal. daily. The general average of Pennsylvania oil produces about 16% gasoline, 50% kerosene, 15% lubricating oils, and 19% residuum or waste, while the California oils produce only 3% gasoline, the other products being 37% kerosene, 34% lubricating oils, and 26% asphalt, residuum, and waste. Thirty years ago gasoline sold for 2c. per gal. and was so little used that enormous quantities were burned in the open air at the refineries, to furnish room for kerosene and other distillates. The price at which gasoline is sold to the consumer in California at the present is from 18 to 20 cents per gal., and the worst is yet to come. D. G. Schofield, president of the Standard Oil Company of California, says that prices of gasoline will continue to rise if the demand increases in the same ratio as it has during the past two years. Of the total storage of oil in California at present, namely some 45,000,000 barrels, 36,000,000 is unfit for the production of gasoline, while not one pint of gasoline can be produced from the 21,000,000 bbl. of oil now held in storage in California by the Standard Oil Company. The local demand has become so great that the supply produced by refining California oils is entirely inadequate, the Standard company having to resort to shipments of gasoline from the eastern fields to supply consumers. It is not surprising under these circumstances that men who are in touch with the situation are eagerly searching for means of relief. A great deal of progress has been made comparatively recently in the development of engines suitable for burning the lower grades of fuel. Some excellent work has been done in perfecting a carburetter suitable for kerosene as a substitute for gasoline or engine-distillate, while engines of the Diesel type are commencing to create a wide-spread interest throughout the entire world. Although early applications of the gas-producer in connection with California oil were not productive of satisfactory results for operating internal-combustion en-

gines, recent developments along these lines have proved much more satisfactory and it is altogether likely that they will find an increasing use in California and the country tributary to the California oilfields. In the meantime attention has been turned to the vast quantity of natural gas that has been allowed to go to waste in the oilfields for lack of a market. The Midway Gas Company, however, is at present installing a plant for piping natural gas from Midway to Los Angeles for domestic purposes, while two companies are producing a good grade of gasoline from natural gas by means of air-compressors and condensers. It is stated that the natural gas produced by the Rice Ranch Oil Co. furnishes approximately $2\frac{1}{2}$ gal. of gasoline per 1000 cubic feet of natural gas. The total output of gas from the wells is approximately 2,000,000 cubic feet daily. While all natural gas is not suitable for the production of gasoline there is no doubt that there is a promising opportunity for investigation and development of this method of producing gasoline. The enormous demand at present with no preceptible diminution should furnish sufficient incentive to interest capital and convert what is now practically a waste by-product of oil production into a means of increasing the wealth of the state and incidentally that of the men who undertake its development.

Zinc is the metal that is engaging the greatest amount of attention in many parts of the world. The time-honoured Belgian method for its extraction continues to be the stand-by, but a good deal of patient study is being devoted to the effort to develop other processes not dependent on a copious supply of cheap fuel and skilled labour. In an earlier letter some of the work being done upon the zinciferous copper ores of Shasta county, California, was described. Butte, as is well known, has also become an important zinc-producing district, through the development of the large zinc orebodies in the Butte & Superior mine and in the properties owned by W. A. Clark. It is claimed that in the Butte & Superior there have been developed over 2,000,000 tons of ore averaging 22% zinc. This company was organized five or six years ago by Lake Superior interests, and the management at first hoped that the zinc ore would be succeeded in depth by copper ore of profitable grade. The blende is free from iron, rendering it readily amenable to concentration, and, now that the value of so large a body of zinc ore is thoroughly recognized, it is hoped that copper will not appear in depth. The ore

was for a time milled at the old concentrator at Basin, Montana, belonging to the Basin Reduction Co., which is now moribund. More recently a 1000-ton concentrator was built at the mine, embodying an oil-flotation process for the recovery of the zinc, but has not yet been operated to full capacity. More recently Hayden & Stone, of Boston, have become interested, and D. C. Jackling has succeeded R. W. Atwater as general manager. Changes are being made in the mill and the technical staff of the Utah Copper Co. will have charge of the alterations. The oil-flotation process used is claimed by the Minerals Separation Co. to be an infringement of their patents and litigation is now in progress. It is generally

struction of a new 350-ton mill, which is now under way on the side of Timbered Butte, a small mountain on the opposite side of the Silverbow valley from the mines. When this is in operation Butte will become one of the important zinc-producing regions.

MEXICO.

Revolution.—That matters are bad there is no doubt whatever, and I am afraid they are daily growing worse. The failure of the Government to take the last uprising in its inception and snuff it out, has placed them in a bad way, for the revolutionary party is daily growing stronger (I am speaking now of Orozco's party) whereas the Government is



IN BOLANOS, MEXICO.

understood that when the mill was in course of design the Minerals Separation made an extremely fair offer to the Butte & Superior, and it is astonishing that, in a district notorious for its bitter litigation over orebodies, a company should deliberately involve itself in an imbroglio over patent rights. It is stated that the company expects to save 90% of the zinc present, yielding a concentrate of 52% Zn. This is shipped to the smelters in the middle West, but experimental work is in progress to devise an electrical method of smelting and encouraging results are reported. Zinc is also produced at Butte from the Elm Orlu mine, owned by W. A. Clark. Until recently this was concentrated in the old mill of the Butte Reduction Works, leased for that purpose from the Amalgamated company, but nine months ago this was destroyed by fire and production has ceased during the con-

fronted not only with the uprising in the north (Orozco's) but what is much more, Zapata and other independent hordes of bandits throughout the entire Southwest. The truth of the matter is that the Press censorship enables you good people abroad to receive but meagre and insufficient reports of the true state of affairs throughout this Republic. I do not want to be considered pessimistic, but in spite of what anybody may state to the contrary, I have good reason to think that permanent peace will be purchased for Mexico at a price of armed intervention. Today, several of the larger camps in Mexico are entirely shut-down. The entire Temascaltepec, Sulstepec, and Zacualpam districts are in the hands of the rebels, and if they were only rebels fighting for a cause, all might be well, but as a matter of fact they are nothing but bands of blood-thirsty freebooters, having no conception of

right or wrong and bent merely on robbery and wanton destruction. Last Wednesday they blew up the Carboncillos mill, utterly wrecking it, as well as all the surface equipment. They have demanded large sums from the other operating companies in that district in order to purchase immunity, and I am expecting any day to hear of the destruction of the Seguranza and La Quimica properties, to say nothing of the probable demolition of such useful things as the Power Company's plant. This is in only one district. The same condition exists throughout the states of Guerrero and Michoacan; portions of Durango are also in an uproar. Sonora is in the hands of Orozco one day and the Federal army the next, with a constant destruction of foreign interests and holdings, between times. Fortunately El Oro, Pachuca, and Guanajuato have been able to continue operations, due largely to the number of foreigners living there, supplementing the garrisons that the Federal Government is maintaining in these districts, but the constant draft from such garrisons to balance the losses in the armies of the North and Southwest, will, I am afraid, eventually lead to trouble. It is practically certain that if the rebels learn that a rich mining centre is unprepared to resist attack they will utilize their opportunity. My opinion is that chaos is growing daily nearer and that the sooner we have a showdown the better, because I have no hesitation in stating that in my opinion the bulk of the intelligent Mexicans would welcome the restoration of law and order even at the cost of American intervention, but the mob would raise hell.

The labour situation is getting to be a serious matter in Mexico and is already making a good deal of trouble; wages are likely to increase and employers will have to put in more mechanical appliances, both on the surface and underground, in order to do away with some of the manual labour. As the men become more efficient in handling mechanical apparatus, they will naturally expect more money. They are already getting more in a good many places. At El Oro they receive good wages. Hoist engineers get 4 pesos per day; mechanics, from 4 to 6 pesos; carpenters the same, and masons only a little less. These, however, are men who have been with the company for a good while and have shown efficiency and steadiness. They seem to get along fairly well at mechanical work when they will stay with it steadily and keep sober. As blacksmiths they are excellent, and as ore-sorters they are incomparable.

CAMBORNE.

Phoenix Mines.—Further capital to the amount of £50,000 is being provided for this property near Liskeard through the instrumentality of Messrs. Bewick, Moreing & Co., which it is hoped will bring it to the dividend-earning stage. After the repayment of the debentures, and payment of underwriting and other charges, there will be £27,000 available for development purposes. This is small enough in view of the present position. Now that the property is under the management of so experienced a firm of mining engineers, better progress should be made, and Mr. Moreing's statement that the energies of all concerned will be concentrated on sinking the new shaft and getting into virgin ground below the old workings is clearly an expression of the right policy. Too much money has already been wasted by not sticking to this work. Already over £80,000 has been spent on the property. The new Prince of Wales shaft (17 by 7 ft. between timbers) has reached a depth of 937 ft. from surface, and only 83 ft. more of sinking should intersect the lode. All the work to date has been done in a most substantial manner and the 80-inch Cornish pumping-engine installed on the main shaft is the best in Cornwall. The pitwork is 18 in. diameter. The record of this great mine in the past, from which ore to the value of over £1,300,000 has been extracted, justifies the expectation that development below the old workings will open up profitable ore.

Treveddow.—This property, situated at Warleggan, near Bodmin Road, has recently been acquired by the Anglo-Nigerian Tin Syndicate and will in future be under the management of Bewick, Moreing & Co. The mine is sunk to the 60-fm. level. The chief product is tin, but some copper has been worked in the shallower levels. The recovery of black tin for the years 1909 and 1910 was about 14 lb. per ton, but seeing that the local working cost, owing to ample water power, did not exceed 9s. per ton for the same period, although probably charges for development were not adequate, the margin is a fairly good one. The old company had an issued capital of £95,000, and debentures £16,400, and it was hopeless to expect to pay dividends on such a capital, in view of the small output. For the ten years 1901 to 1910 inclusive, 518 tons of black tin was sold.

The Prince of Wales, at Calstock, has been acquired jointly by the West of England Tin Corporation and E. S. King. The mine has been worked to a depth of 200 fm. and

has been a fairly good producer in the past. There is still much ore standing above the 180-fm. level, which was covered by water, through the pump being idle during the coal strike early in the year. The mine is equipped with a 50-inch Cornish pumping plant, a mill of 60 Cornish stamps, and a dressing plant, so it should not be long before returns are made.

The Killifreth mine, near Chacewater, adjoining the Great Wheal Busy, is to be reopened, a company being in process of formation with a nominal capital of £100,000, of which £40,000 will be working capital. It has been worked to a depth of 100 fm. under

aging 150 lb. black tin per ton for the whole 20 fathoms. The concentrate sold by this company is of excellent quality, the last parcel realizing £149. 7s. 6d. at the Tin Ticketing.

Falmouth Consolidated.—The ore at the Wheal Jane mine, near Truro, belonging to this company, is highly pyritic, containing much pyrite and smaller quantities of chalcopyrite and arsenopyrite. The ore assent to the stamps is reported to contain 18 to 20 lb. black tin per ton by the vanning assay. The first concentrate contains about 160 lb. per ton and 28% sulphur. This concentrate is dried and roasted in a Humboldt furnace, and the pro-



CARNON DRESSING PLANT, FALMOUTH CONSOLIDATED.

adit, and was closed-down, not on account of the poverty of the ore, but because of the low price of tin, and the default of the largest shareholder in the company.

Gwithian Beach.—Oliver Wethered and other London capitalists have acquired the right to treat the sand at the mouth of the Red river. For many years, the fine tin which has escaped the numerous streamers' plants situated along the Red river has been deposited on this beach. The sand has been handled on a small scale for some time past at a fair profit, but careful selection was made.

Grenville.—One of the best pieces of tin ground discovered in Cornwall for some time is in a rise from the 355-fm. level west of Fortescue's shaft to the 335-fm. level, aver-

aging 150 lb. black tin per ton for the whole 20 fathoms. The concentrate sold by this company is of excellent quality, the last parcel realizing £149. 7s. 6d. at the Tin Ticketing.

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duct passed through pulverizers, for the purpose of freeing as far as possible the particles of black tin from the adhering friable oxide of iron without further comminution of the tin. The discharge is sent to another set of tables and buddles for the recovery of a clean tin product. The Humboldt roaster is of interest, as it has been designed with the objects of preventing further attrition of the material and of reducing the amount of fine material carried away by the gases. The furnace is of the multiple-hearth type with central vertical shaft carrying rotating rabblers. To achieve the former object, the passages delivering the material from one floor to that below are made with a gentle slope; and for the purpose of preventing much dust being carried away,

different passages from one floor to another are used for the ascending gases from those used for the travel of the concentrate downward. The battery contains 60 stamps, weighing 1250 lb. each, crushing 3.5 to 4 tons per 24 hours. Only 40 are running at present, pending the completion of the third Humboldt furnace; in fact it is not possible yet to roast the whole of the current output of the 40 stamps. The monthly tin sales do not therefore correspond with the tonnage milled. Absorption towers and condensers have been erected for the prevention of the escape of the sulphurous gases. The arsenic is recovered in flues in the usual way.

North Dolcoath.—This property at Cambridge has recently been acquired by Oliver Wethered and others, and work has already been commenced. The mine was first started in 1857 on an argentiferous gozsan and silver to the value of £5000 was produced. There is already a shaft on the property to a depth of 90 fathoms.

NEW YORK.

Prosperity.—The closing of the month of September brings with it the assurance that the long awaited growth in the material strength of the country is at hand. Indications of this are on every side. Economists and historians lay down the rule that agricultural wealth spells national prosperity, and so in this case the hopes that were entertained in the spring and early summer for a large agricultural yield are now brought to fulfilment. The months of July, August, and September, which by drought or heavy rains can work such havoc in the great producing states of the Middle West and South, have furnished ideal conditions: so that all the crops, with the exception of corn and cotton, which are the last to reach maturity, are now practically assured. These last two crops, perhaps the most important, have enjoyed continued favourable conditions for their maturity, with still further increased promise that corn will give a record yield, and that cotton, while not up to last year's enormous crop, will be amply sufficient to supply the needs of the mills at a price that will permit good operating profits and that will, at the same time, give a fair return to the growers. It is as yet too early to give actual figures on the value of the agricultural yield, though those who are bold enough to prophesy believe it will exceed \$9,000,000,000.

This agricultural prosperity has already been reflected on the railroads, which in the last few years have been so severely affected

by the adverse legislation and rate control of the Interstate Commerce and Railroad Commissions. Although their net earnings leave something to be desired, the gross returns are of record proportions. Last month a group of the leading Western roads showed an average increase of 11.17%, and a group of the leading Eastern roads an average increase of 9.6%. We have already made reference in a former letter to the expansion of the steel industry, which is now enjoying almost unprecedented activity. At the end of August the unfilled orders of the steel corporations totalled 6,163,375 tons, as against 3,695,985 at the close of August last year. There is no question but that the activity which is shown in this, what might be called basic business, is widespread throughout the smaller industries and that increasing profits are showing in practically all lines of business endeavour. As yet this general prosperity has had but little effect on the stock market, other than giving it an inherent strength by which it has steadily resisted such adverse influences as unsettled political conditions, the unexpected demands of England in connection with the Panama Canal, and a tight money-market.

The political campaign of the three parties, Democratic, Republican, and Progressive, is arousing a general, though not as yet a frenzied, public interest. There are two principal issues in the present campaign. The first is the reduction of high tariff; the second is the extent to which the Constitution of the United States ought to be modified, by interpretation or actually, in order that the National Government may deal with certain grave measures of social, industrial, and political reform. The parties and the candidates are distinctly separable on either one of these two issues, but not on the combination of the two. The Republican party is strongly Protectionist, and conservative on the constitutional questions. The Progressive party is Protectionist, but radical on the constitutional question. The Democratic party advocates a tariff for revenue with no destructive immediate reductions, and on the constitutional question is more conservative than the Progressive party and less conservative than the Republican.

Colonel Roosevelt and Governor Wilson, the candidates of the Progressive and Democratic parties, are at present actively engaged in campaigning. The reception of Governor Wilson throughout the middle-western and western states, where he has been on tour, has been generally warm and enthusiastic, this despite the hopes of his opponents that a

'pedagogue' and 'scholar' would fail of support in these sections. President Taft has seen fit to stand on the record of his administration, and is avoiding the entanglements of the active political arena. We believe that this attitude, so much more dignified than his pre-convention efforts in June and July, is appreciated, and that he is thereby gaining slightly in popular favour. In the meantime the Roosevelt-Progressive boom is apparently losing ground; while all indications lead one to believe that a Wilson-Democratic victory is reasonably assured.

Stringency in the money market has been apparent for some time, owing to the general demand for money to finance at the same time the moving of large crops and the transaction of a heavy volume of mercantile business. However, there has not at any time been any real anxiety, owing to the presence of three sources of relief, namely, the importation of gold, the willingness of the Treasury department to increase the Government deposits in the banks of New York and elsewhere, and lastly the ability of the National Banks to issue emergency circulation to an amount quite sufficient to relieve any temporary tension. It has been necessary to tap only the first of these sources, engagements for several million dollars worth of gold having been arranged recently in London for shipment to New York. As the movement of crops has already commenced, the strain in the monetary situation will probably become less acute from now on.

Mexico holds out little promise of returning to even comparatively normal conditions, with the revolution firmly planted in nine states: Chihuahua, Sonora, Coahuila, Morelos, Oaxaca, Guerrero, Michoacan, Mexico, and Vera Cruz. President Madero has failed to make any headway in clearing the country of the bands of revolutionists and brigands. Orozco is still the most powerful leader with which the Federals must contend, though several other 'revolutionists' are doing much damage, finding safety in working through the mountainous districts. According to private advices received from Mexico City the situation continues to be one of contradictory occurrences. A short time ago another outrage was committed in Morelos, similar to the attack and massacre on the train of the Cuernavaca line. The followers of Zapata are to be found in the Federal district only 20 miles from Mexico City, and the authorities seemingly cannot drive them out. Between laws covering the "suspension of personal guaran-

tees," talk about attempts to grant amnesty to the rebels north and south, reports of renewed activity by the rebels and Federals, the whole situation is very confusing and unsatisfactory. The mining interests of foreign countries are consequently in continual jeopardy. Where property has not actually been destroyed, operations are impossible owing to the general crippling of the railroads. As an extreme instance of this, the mine and smelter production of the Phelps-Dodge and Greene-Cananea copper properties, situated on and just south of the border, have been considerably affected this past month. That there has been a 'working agreement' between the Federal army leaders and the rebel chiefs has been indicated for some time to those who are in close touch with the situation. The rebels, operating just south of the Arizona border, and unhampered by Federal troops in the vicinity, have made preposterous demands upon American mining interests for money. It would appear that both sides of late have been in the field for financial gains only. Although confirmation has not been obtained the rumour is frequent that the Mexican Government is again attempting to make a loan, which will call for approximately \$50,000,000. Considerable doubt is felt that bankers in this country will again be willing to underwrite the promises of President Madero, in view of his past disappointing record.

The copper trade still continues active with the price of the metal firmly established at 17 $\frac{3}{4}$ c. per pound. There seems to be a general feeling that the copper properties will increase their dividends. This was borne out last week by the increase in the Anaconda dividend.

The high price of copper has enabled such companies as the Utah, Nevada Consolidated, Amalgamated, and the Lake Superior mines largely to increase their profits for the past quarter, and as there seems to be no immediate prospect of the metal declining it is believed that dividend rates will be raised. Initial dividends will soon be expected from Chino and Ray. The strike of the miners for higher wages at the Utah and Nevada properties resulted in the closing-down for a short time of operations at both mines. Also a large amount of copper was kept from the refineries when it was most needed. The Nevada Consolidated management, however, effected a settlement of the dispute and that mine is again under operation. The Utah property still remains idle, but it is expected that a settlement with the men will be reached shortly.

METAL MARKETS

COPPER.

Average prices of cash standard copper :

Sept. 1912	Aug. 1912	Sept. 1911
£78. 17s. 5d.	£78. 17s. 1d.	£55. 7s. 1d.

This market has again fluctuated within very narrow limits. Speculators have been restrained by political uncertainties, and so have failed to take advantage of the magnificent trade conditions. Appreciation of these conditions comes chiefly from America, where both production and consumption have reached record dimensions. Works there, indeed, would be running night and day but for the difficulty of securing labour. Similar difficulties are being experienced at the mines and both the Utah and Nevada Consolidated have been closed by strikes. The leading producers have advanced their price in Europe to £82. In America sales as high as 18 cents have been reported. At the present level, manufacturers are naturally reluctant to carry large stocks, and few of them have the confidence to buy ahead. The danger that threatens, as the result of diminishing European stocks, is that should urgent demands arise they cannot be met. The standard market has on several occasions shown vigour, but has been restrained by the realizing of warrants bought during the slump three months ago. The figures for the deliveries of copper by the American Copper Producers during September show a substantial decrease in both exports and home buying as compared with the previous month, and the stocks have therefore slightly increased.

TIN.

Average price of cash standard tin :

Sept. 1912	Aug. 1912	Sept. 1911
£223. 19s. 6d.	£208. 3s. 0d.	£180. 16s. 11d.

The continued eager demand has resulted again in higher prices. American orders, which were being withheld in the earlier part of the month, came out in large volume toward the middle, and suddenly gave an appearance of great strength to the market. Efforts were made to restrain the upward tendency on the eve of the Banka sale, and a bear raid succeeded in breaking prices £6. The market however did not follow these operations and a speedy recovery was made. The 2460 tons of Banka tin sold at the average of £224. 12s. 6d. Following the sale, a broad buying movement carried prices up to £233 spot and £231 10s.

three months. The month closes with prices about £2 under these figures, and with an increase of 1972 tons in the visible supplies.

LEAD.

Average prices of soft foreign lead :

Sept. 1912	Aug. 1912	Sept. 1911
£21. 9s. 0d.	£19 5s. 8d.	£14 15s. 1d.

This metal has had a sensational rise owing to the scarcity of spot material. As much as £23. 15s was at one time paid for September delivery, December delivery at the same time bringing £21. 10s. Shipments were hurried from the continent to relieve the situation, and the market has gradually resumed a more normal aspect with spot at £21. 10s. and forward £21. 5s. The situation is still strong, and a further rise is not unlikely. Many purchases have been withheld for the closing of the Baltic navigation, while stocks are entirely depleted at smelters' work.

SPELTER.

Average prices of ordinary brands :

Sept. 1912	Aug. 1912	Sept. 1911
£26. 17s. 0d.	£26. 1s. 2d.	£27. 12s. 7d.

Spelter is in very strong demand and the syndicate has raised the price by 12s. 6d., in three separate stages during the month. Consumers' demands are difficult to satisfy, only limited quantities remaining available in producers' hands. America has been inquiring. The situation there is remarkably strong, as production has reached a maximum and consumption is expanding. The price is so high in America that the tariff would not seriously interfere with imports. The new source of supply in Montana is not yet an important factor.

OTHER METALS AND MINERALS.

Prices quoted on October 10 :

SILVER.—29½d. per oz.

PLATINUM.—185s. per oz.

BISMUTH.—7s. 6d. per lb.

CADMIUM.—3s. 3d. per lb.

ALUMINIUM. £79 to £81 per ton.

NICKEL.—£170 per ton.

ANTIMONY.—£34 to £36 per ton.

QUICKSILVER.—£8 per flask.

MANGANESE ORE.—9d. to 1s. per unit (1%).

IRON ORE.—Cumberland hematite 26s. 6d. per ton at mine. Spanish 23s. delivered in England.

PIG IRON.—Cleveland 67s. per ton. Hematite 80s. per ton.

WOLFRAM ORE.—28s. per unit (1%).

MINE VALUATION AND MINE FINANCE

The redemption of capital. Issue of debentures instead of shares. A practical proposal.

By H. C. HOOVER.

THERE has been during recent years a most elaborate discussion among engineers on the subject of mine valuation. While the factors involved have been amply illuminated, I hold that such discussion remains at least partly academic until it has been interpreted into terms of practical finance. It should be possible to express these principal factors of valuation in the terms of practical finance at the initial capitalization or re-sale of mines, and to do so not only in such a manner as to protect the investor, but also to provide for the very necessary position of the vendor or promoter.

In this matter of financing mines, our technical journals teem with discussion, but almost wholly in the shape of destructive criticism. Since mines must be financed, and as human nature is likely to remain unchanging and unchangeable, such discussion is to little purpose. I venture to offer what I consider, and have found in practice to be, a practical method of financing mines upon their initial sale. My suggestion will, I believe, at the same time serve to adjust the engineer's viewpoint to the ultimate purpose of the valuation of mines for sale purposes, and exercise a desirable reactive effect on valuation problems generally.

The valuation of a mine involves two parts of widely different risk, that is, the profit assured and the prospective value; therefore it is but logical that the mine, when financed, should be capitalized into securities directly interpreting this varied risk, namely, Debentures representing the profit assured, and Shares representing the prospective value. For convenience in discussion, this Debenture may be termed an 'assured profit debenture.' Later I shall more fully elaborate what is intended by this expression. I do not put forward the idea of debentures or bonds on a mine as at all novel, as such issues are not uncommon, especially in the case of copper mines, but it has been done as a financial expedient, and not as an intentional definition of the relative risks of capital, based on the factors involved in the mine itself.

Some attempt was made in the direction of interpreting values into capitalization by the proposal that mines with good probabilities of

extension should be capitalized on a basis of from 20 to 40% in excess of the profit assured. This rough suggestion has been sufficiently discredited in both theory and practice as scarcely to need any further remark, although it may be worth while to review the fundamental objections thereto. The quantity of ore that may be proved is largely the result of managerial policy and it is quite possible that the assessment of the prospective value on a percentage basis will be out of ratio to the probabilities: either too much or too little. The two extremes are (1) that no mine starts at the surface with any considerable amount of proved ore, and yet this is the period when its prospective value is the greatest; and (2) it is possible to conceive of this mine as developed to the 3000-ft. level with the whole of its ore intact, so that the prospective value becomes of diminutive importance in relation to the ore reserve, and as compared to the first case. Further, any such basis of valuation fails to take into account the widely-varying geologic character of mines; it disregards any collateral evidence, such as that of continuity from neighbouring mines or the general experience in the district. Logically, therefore, the prospective value can be simply a factor of how far the ore in the individual mines may be expected to extend; it is not a factor of the remnant of ore that may be still unworked above the lowest level; and certainly it is not a factor to which any mathematical basis can be applied.

The meaning of the expression 'profit assured' always requires some definition, because the factors involved in this term are capable of infinite variation and subversion, and no empirical expression of this kind can be accepted without amplification. Such expressions as 'proved ore,' 'probable ore,' etc., which are usually based on the amount of development openings on three sides or on two sides of a block of ore-bearing ground, are all open to grave objection, for they represent an attempt to define geologic and economic factors in terms of holes in the ground. For instance, it is currently accepted that ore developed on four sides is 'proved' and that ore developed on one side is, at most, 'probable,

but it is often the case that a block of ore included within four development openings is so large that a large portion of the interior of such a block is highly problematical, and, on the other hand, there may be a considerable amount of absolutely proved ore along an opening on one side only.

While economic factors such as the price of metals, extraction, equipment, working cost, etc., are involved in any question of profit assured, yet the factor of greatest uncertainty is a geological one, namely, the continuity of the ore through a mass of rock beyond the surfaces exposed and sampled. We can relegate the first series of factors to constants, but the geologic factor is a variable, to be gauged approximately, at most. My own view is that the risks involved in this variable can best be expressed in terms of the actual distance assumed for the extension of ore beyond the face sampled. The actual distance to be taken in any particular case is dependent on the character of the deposit, experience of the mine, and so forth. It may vary all the way from 10 feet to 250, but, in any event, the statement as to what distance is assumed affords a far better definition of the risk recognized than any scheme of 'probable ore' or such corollary remarks as 'proved on three sides,' or 'on two sides,' etc. The expressions 'proved ore' and 'profit assured' can be made synonymous by the introduction of such constants as cost, extraction, price of metal, etc. Any given statement of profit assured, in order to define the weight given to various factors, must include information as to the constants introduced into the calculation. In other words, any statement of profit assured must be extended to give (1) the tonnage of ore; (2) the maximum distance in feet that the ore has been assumed to continue beyond a sampled face; (3) the average value; (4) the percentage of extraction assumed; (5) the working cost; (6) if other than a gold mine, the price of metals assumed; (7) the cost of new equipment necessary to recover the profit; (8) the loss of interest involved during the period necessary to recover this profit. Profit assured after a proper consideration of these factors is security worthy of a debenture or a bond redeemable out of this profit.

The prospective value outside of the proved areas is in no case capable of representation in quantities; in the last analysis it degenerates to a matter of individual opinion, in which the governing factors are a blend of psychology and geology.

I do not believe that the value of a mine

can be determined or interpreted in money by any algebraic formulae, no matter how complicated. Those who attempt to do so must ignore the insistent speculative factors that are involved in the expressions 'proved ore' and 'profit assured.' In this matter also there is a good deal of the personal equation, metallurgical and economic and geologic risk, even when the data are taken with the greatest care and intelligence.

In any event, there is a distinct and broad line to be drawn between these two items in the valuation of any mine, and it is at this point where it is possible to adjust the capital on its initial presentation to the investor so as to represent fairly well these two distinctions. The investor in, or purchaser of, a mine may be expected certainly to pay an amount for the mine represented by the profit assured (adequately based), and also to pay something for the prospective value. Therefore if in the capitalization of a mine we represent the profit assured by debentures, redeemable in principal and interest out of such profit, and we assign the whole of the share capital to the prospective value, we shall, in a broad way, have distinguished in tangible finance the difference of risk involved. In such a case the share capital is wholly speculative and, in effect, represents the future of the property outside of the developed ore. It becomes immaterial as to how many shares represent the prospective value, for it becomes simply a matter of convenience in the adjustment of the various interests involved. If, therefore, the promoter or the vendor, in offering the mine to the public or to the private capitalist, whether he offers it for sale or merely desires to secure working capital, would formulate his finance on these lines and offer debentures for the money subscribed, he has a right to a considerable proportion of the share capital.

The promoter or the vendor usually approaches the capitalization of a mine from one of two points: either to sell the property for cash, or cash and shares; or, to secure working capital for its development and equipment. In the first case the investor or the capitalist has the right to demand that the vendor or promoter shall be content with the cash realized from the debentures, less working capital necessarily left in the company's treasury, and with a portion of the shares. Inasmuch as the factors involved in the calculation even of 'proved ore' are to some degree speculative, the investor is entitled to a good deal more interest than the 5% that he can get on gilt-edged securities. Consequently he should have such

a debenture at 6%, with some discount, and also have a bonus in shares, and, as a matter of prudent and practical finance, equally beneficial to the vendor and the purchaser, such debentures should further be made convertible into shares. In the second case, where the vendor or promoter is only seeking for working capital and where such working capital may be considerably less than the profit assured, then, if the mine should be capitalized on this basis, the promoter or vendor should himself receive debentures representing any residue of difference between the profit assured and the working capital required, and there should be a proper adjustment of the share interests on this basis. It might be suggested to introduce into this discussion, in addition to 'proved ore,' the factor of ore only partly speculative and allow it to be represented by preferred stock. As preferred stocks are not redeemable, however, such a suggestion need be pursued no further. Moreover, if the above basis of discrimination in character of risk be carried out, the ore often classed as 'probable' will fall in some proportion into 'proved' ore (because ore opened on one side represents some tonnage absolutely proved) and in major proportion will fall into 'prospective' ore, where it only too often wholly belongs. One advantage of such a method of capitalization is that it often forms a much easier basis to negotiate as between the capitalist and vendor, and many a negotiation, practically hopeless from the point of view of division of share capital alone, becomes quite feasible on the introduction of a debenture redeemable from the profit assured.

Such broad lines of division are practically represented in the great railway systems in the matter of their issues of debentures and common stock, and, growing out of this division, by which the greater security is given a less, but secure, return, there have arisen great numbers of investment trusts whose business it is to hold the less speculative securities in such enterprises. There would in time grow a sentiment favouring the creation of investment trusts in connection with mines, to hold primarily the less speculative portion of the securities as outlined above. These could approach the whole mining industry with a much greater amount of assurance as to positive return than is possible on the basis on which exploration companies have been largely conducted in the past.

The general public makes its largest losses, in mining, over new issues. The facts regarding old-established mines become well known

in time, and their quotations in a general way reflect their value. The method just outlined has the important advantage of differentiating the substantial portion of the mine-value from the entirely speculative portion, and also differentiates the mine of substance from the development gamble. It is in the misleading of the investor over this last type of mining (which is legitimate enough in itself) that just complaint lies. Too often the prospect is offered as a mine, or share-capital that is largely speculative is offered as of proved value. The capital of the undeveloped mine should all be shares, and as such would be on a parity with shares in a mine carrying an assured-profit debenture. In the initial stages the debenture would be in itself the evidence of substance. By the time the debentures are redeemed the mine will be standing in public estimation fairly on its own merits. A further advantage, from the public point of view, lies in the fact that if the promoter or vendor under-estimates the capital necessary to bring the mine to production, he will have to pay the penalty in the loss of his entire share-interest through foreclosure of the debentures, or, alternatively, to supply the money to prevent such an event.

The Exposition at San Francisco which is to celebrate the opening of the Panama canal is coming on nicely. After the site was finally selected it was necessary to secure title to over 200 pieces of real estate. It is worth noting that the longest delay came from the stubborn fight of the richest land-owners concerned, Mrs. W. K. Vanderbilt and Mrs. Herman Oelrichs, a considerable portion of whose fortunes by the way came originally from the Comstock lode. However, the land was eventually secured and work is now under way. Dredges are busy excavating for docks and filling along the shore, plants are being set, and the architects are completing plans for the buildings. It is estimated that the exposition is fully eight months ahead of any other at the same period. Over 40 states have made arrangements to take part and 15 foreign governments have accepted the invitation to participate. No appointments have yet been made in the Department of Mines and Mining and this has led to criticism of the officials. The California Miners' Association, long a powerful organization for publicity, has become interested and is arranging a convention to be held this fall to stimulate interest in mining exhibits at the exposition. An International Engineering Congress is to form one of the features of the year.

PERSONAL

J. A. AGNEW has gone to Thames, New Zealand.

FERGUS ALLAN sailed on the *Minnetonka*, returning to El Oro.

H. FOSTER BAIN, editor of the *Mining & Scientific Press*, is at New York.

A. CHESTER BEATTY has returned to New York.

HANS C. BEHR is leaving the Rand.

F. K. BORROW has returned from Colombia.

CYRIL BRACKENBURY has returned from Greece.

FRANCIS P. BRAY, general manager for the West Africa Trust, is home for his annual holiday.

WALTER BROADBRIDGE has returned from Chile.

WALTER L. BROWN is now with the Abontiakoon Mines, in West Africa.

GERALD M. BROWNE left on September 28 for the United States.

CHARLES BUTTERS sailed for New York by the *Mauretania* on October 12.

GEORGE B. BUTTERWORTH has returned from Colombia.

W. A. CARLYLE has returned from Mazapil, Mexico.

J. M. CALDERWOOD, consulting engineer to the Messina Development Co., is here from Johannesburg.

H. N. G. COBBE sailed on September 25 for Georgetown, in British Guiana.

J. H. CURLE went to Bogota, Colombia, and is expected in London.

ALLAN DAVIDSON is manager for the Jemaa Exploration Co., in Nigeria.

JOHN B. FARISH is in San Francisco.

J. H. FENNELL left on September 18 for Nigeria.

OLIVER B. FINN is in Quebec, Canada.

A. E. FLYNN has left London for the Nipissing mine, Cobalt.

R. T. HANCOCK is here from Nigeria.

W. F. HANNES is here from Rio Tinto.

W. PELLEW-HARVEY was recently in the Caucasus.

FREDERICK HELLMANN was recently in California.

E. MACKAY HERIOT is in Spain.

C. S. HERZIG is on his way to Australia.

J. I. HOFFMANN, of Johnson & Hoffmann, was recently in Serbia.

W. L. HONNOLD succeeds the late J. G. Hamilton as managing director of the Consolidated Mines Selection Co., at Johannesburg.

H. C. HOOVER is in California.

A. K. HUNTINGTON has been elected president of the Institute of Metals.

GEORGE C. KLUG has been appointed managing engineer for the British Broken Hill Proprietary.

C. E. KNECHT is now consulting engineer to the Brakpan Mines.

W. RYAN LEWIS is with the Amo Tin Mines, at Naraguta, Nigeria.

TREVOR E. MACE is in the employ of the Tasmanian Metals Extraction Co., at Rosebery, Tasmania.

J. LESLIE MENNELL has left Mexico and is living in England for the present.

T. BURNS MCGHIE has left for the Bwana M'Kubwa copper mine in Rhodesia.

FREDERICK H. MINARD returned to New York by the *La France*.

F. DOUGLAS OSBORNE, of Perak, is in London.

LLEWELLYN PARKER, just appointed to be manager for the Famatina Development Co., sailed for the Argentine on October 2.

H. A. POWER is in Nova Scotia.

F. PERCY ROLFE is now assistant-manager at the Consolidated Langlaagte Mines.

JOHN SAXTON is now at Asiakwa, West Africa.

A. C. E. SEALE has returned to the Gold Coast.

E. GYBBON SPILSBURY was recently in Texas.

A. ERNEST THOMAS has opened an office in Market Place, Camborne.

F. J. TREGAY succeeds A. J. Rickard as manager of the Barramia mine in Egypt.

H. L. TWITE, of Twite & Steinhart, is in Norway.

E. C. VIGEON has returned to the Spassky Mine, Siberia.

A. WAUCHOPE is superintendent of the Yuanmi mines, in Western Australia.

E. J. WAY is here from the Rand.

MORTON WEBBER has moved his office to No. 2 Rector Street, New York.

FRANKLIN WHITE has left Rhodesia and has gone to Hillgrove, New South Wales.

ERNEST WILLIAMS has opened an office in Salisbury House.

LESLIE J. WILMOTH has been appointed metallurgist at the New Chuquitambo gold mine in Peru.

THE MURCHISON RANGE

An outside district in the Transvaal, its early history, and future prospects when the new railway is completed.

By ALEXANDER O. BROWN.

THE Selati Railway which will provide the northern Transvaal with its most direct route to the coast at Delagoa Bay has now reached the Leydsdorp district in the Murchison range and this presents an opportunity for reviewing the conditions in this little-known district.

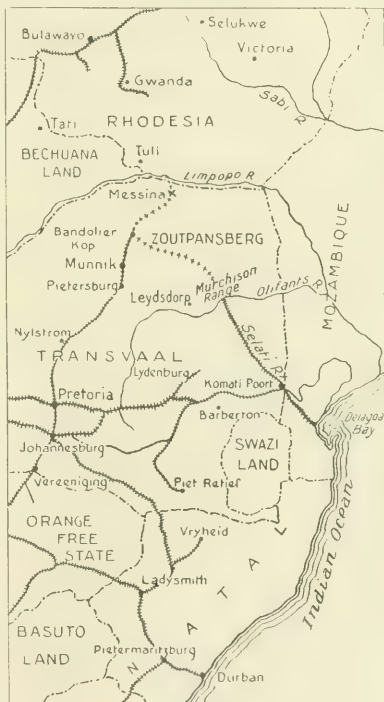
The railway has been long and anxiously awaited not only by the inhabitants, chiefly prospectors, but by all interested in the region. While it is likely that too much prospective value has been given to the influence of the railway on the welfare of the district, it is at least certain that it will greatly reduce the cost of transport and of living, and, with the improved means of access, will give the region a chance of becoming a mining area instead of remaining a network of unproductive claims.

The Zoutpansberg, in which the Murchison range is situated, is a tract of country roughly 150 miles square lying mostly to the north and east of Pietersburg, which is 12 hours north by rail from Pretoria. The Zoutpansberg mountains run east and west in the northern part of the division: between them and the Rhodesian border is the well known Messina copper mine, which will connect with the Selati Railway and thus secure rail-transport to and from the coast.

On the western side of the division are the Drakensberg mountains. In coaching from Pietersburg to Leydsdorp the landscape is varied pleasantly, the road traversing first the bare middle veldt around Pietersburg and then the picturesque kloofs of the Drakensberg leading down to the wooded bushlands of the low country. This low country extending east of the Drakensberg to the Portuguese border is for the most part a great plain, about 2,000 ft below the middle veldt and 1,500 ft above sea-level, only broken here and there by a low range of hills or isolated kopjes that may be likened to islands in a sea of trees.

The Murchison range in the south of the Zoutpansberg consists of lines and groups of hills (never more than 600 to 800 ft. above bush-level), which extend for about 35 miles from Thabina on the west to Castle Kopjes on the East (see map page 281). The main coach road from Pietersburg runs through Thabina to

Leydsdorp, which is the mining and official centre. Leydsdorp is a very small village 90, miles by road from Pietersburg, consisting of



SOUTHEAST AFRICA, SHOWING POSITION OF MURCHISON RANGE.

one hotel, a post office, a hospital, a mines office, and several stores. There is a small fixed population of officials and a fluctuating addition of prospectors of various kinds. Trans-

port at present is by waggon to Munnik, which is 30 miles from Pietersburg on the Bandolier Kop line. The old rate from Pietersburg by road was 6s per 100 lb. The new railway will eliminate this costly waggon-transport, and as will be seen on the accompanying map will reduce the rail distance to Delagoa Bay from over 500 miles to about 200 miles, with a corresponding reduction in freight.

From Leydsdorp a roads runs through the range to Palabora and Lulu Kop, some 50 miles to the East. Considerable prospecting work for copper has been done here recently by two English companies. In spite, however, of extensive ancient workings and indications of metal, the work has not led to the discovery of any substantial orebodies; hence operations at present are suspended. The work has tended to prove that the size of the old workings bears no relation to the size and value of the orebodies according to modern standards and that the ancient people, of whatever date, were content to work laboriously the ore that now would be quite unprofitable.

The deposits consist of impregnations in a pyroxene rock, which appears to be a segregation from a granite forming part of the 'Palabora plutonic complex' as it is termed by the Government Geological Surveyor. Lulu Kop differs from Palabora in being formed of a body of metamorphosed limestone (probably a xenolith) overlying the pyroxene rock, but the genesis of the ore was probably the same in both places. Farther east, toward the Portuguese border, the country is less explored. Some mica and corundum near the contact between the Palabora granite and an older granite, into which it is intruded, have been located but nothing of a definitely promising character has been found. It is, perhaps, as a possible tin country that the region east of Palabora is chiefly interesting. There are two contacts, namely, between the two granites and between granite and schist. As pegmatite dikes are common, the geological conditions are favourable for the discovery of tin, many of the associated minerals of which have been found already.

Reverting to the Murchison range itself, the predominating rocks here are the Swaziland schist (the oldest rocks in the African geological scale) similar to those of the Barberton district and Rhodesia, with which the mining conditions of the range may be compared.

The results of the recent geological survey of the region are not yet published, but for the present purposes the range may be considered as a tongue of schist, surrounded by granite, as approximately indicated on the sketch map.

Whether the schist is derived from rocks of sedimentary or igneous origin and what may be the relative age of the granite intrusions are matters of geological interest on which no doubt much light will be thrown by the recent work of the Government Geological Survey.

The schist includes hornblende and talcose schists. Some zones, however, appear to have received an impregnation of silica, and much of the range owes its existence to the superior resistance to denudation offered by bands of silicified rock.

In considering the mines and prospects, it is natural and convenient to regard them as belonging either to the northern 'antimony' zone, or the southern 'pyritic' zone. These two minerals conform generally with two parallel lines of hills running east and west.

The antimony zone, as at present known, extends from east of the Free State mine to Gravelotte on the west. The pyritic zone extends from La France on the east, where it is quite near to the granite contact, to beyond the Sutherland lode on the west. At a point about a mile east of Leydsdorp there is a branching spur of hills extending toward Thabina. The antimony zone is at present the most active. It is asserted that the problem of the separation of the gold from the antimony (including the recovery of the antimony) has been satisfactorily solved. If this is so, when some economical supply of water—probably by pumping from the Selati river, 10 miles away—has been obtained, there would seem to be a good prospect of several promising mines being opened up on this line.

The gold occurs in stibnite associated chiefly with quartz and pyrite. The orebodies are lenticular, one lense succeeding another in a way characteristic of a schistose country. The ore is not confined to one lode but occurs in parallel bodies. This is particularly the case on the United Jack property, where several lodges have been found. The Weigel gold mine and the United Jack mine are in course of active development, although at present only to shallow depths of 100 to 150 ft. The Free State mine was formerly proved by a shaft to 300 ft. and by boring to 500 ft. It was difficult locally to obtain reliable information regarding the lode and its assay-value at this depth, but both probably were of an irregular character. It seems likely that want of water and the difficulties of extraction were important factors in the shutting-down of the mine.

Encouraged no doubt by the advent of the railway, the Gravelotte mine, the most westerly

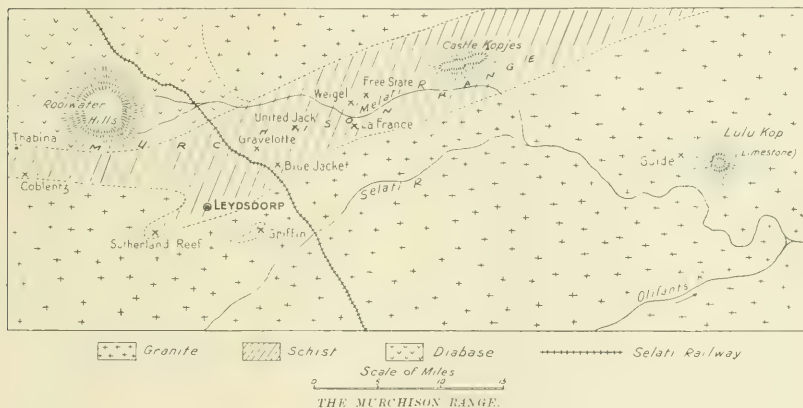
of the series, is said to be started again.

The pyritic zone consists of several parallel bands of schist. Quartz leaders and lenses traverse the schist, but they are usually small and irregular both in dip and strike. Where the schist has been silicified, the formation rises into a kopje on which the unaltered pyritic ore is found at a depth of a few feet. On the flats, as at the La France, oxidation has extended to at least 100 ft., providing free milling ore to that depth.

The La France was opened up 20 years ago. In recent years water for a 5-stamp mill has been obtained from the Melati river. This supply could be improved and the mine would seem to justify further attention, particularly

quently caused work to cease in the past has been the uncertain character of the quartz leaders, which have often proved practically impossible to mine owing to their irregularity, both in size and value. It is to be observed, however, that these leaders, in some cases at least, should be regarded as only portions of pyritic schistose zones, and from work done it was concluded that there was a fair probability of opening up large bodies of low-grade schist in this neighbourhood.

The Sutherland Reef, to the west of Leydsdorp, is the largest and deepest mine in the district. The lode was proved to 600 ft., and good ore was being raised until the last two years. During the war the mine was worked



with a view to proving the ore below the zone of oxidation.

Going west, the next mine is the Blue Jacket, from which some exceptionally rich ore, in limited quantities, was taken in the early days. This mine and the Free State are held by the H. E. Proprietary company, from which company the Blue Jacket mine is at present held on tribute. In expectation of success a pumping-station on the Selati river was erected by the previous owners, but work was stopped owing, it is said, to unfavourable developments at the 200-ft. level. The mine being now on tribute, it is probable that the method of following the lode thus entailed may prove to be the best way of further exploring the mineral bodies.

There are several prospects in the neighbourhood of the Blue Jacket, some on the flats, others on the kopjes. A feature that has fre-

quently caused work to cease in the past has been the uncertain character of the quartz leaders, which have often proved practically impossible to mine owing to their irregularity, both in size and value.

On the spur of hills branching from the pyritic zone toward Thabina, there are several prospects, notably the Coblenz, none of which, however, were being worked in January last. Although narrow rich leaders may occur on these, they must be regarded generally as low-grade schist propositions of varying size. The Griffin mine is south of the pyritic zone and near the granite, which here surrounds a patch of schist. There is a 10-stamp mill in operation, and although considerable variation has occurred in the grade of ore treated, recent developments in the mine, which is only proved to a depth of some 150 ft., are said to have been favourable.

The Government is considering a scheme for supplying water to the Range, and it is likely

that some co-operative scheme—Government or otherwise—will solve this difficulty, which for a small mine would be serious. A larger mine, however, could afford its own pumping-station and pipe-line from the Selati river; this would yield a good supply of water except during about one season in ten. The whole of the low veldt is well wooded and fuel is plentiful. Coal also will be available from Middelburg by the railway at a low figure. Labour is generally sufficient for present needs, and in the event of operations on a larger scale it could probably be organized to meet a larger demand.

Leydsdorp is, generally, a district in which with improved means of transport and the installation of an adequate water-supply, working costs should be reduced to a low figure. Apart from individual mines the future of the Leydsdorp district seems to depend chiefly on two factors, namely (1) The economical and successful working of the solution process for the extraction of the gold from the antimony ore. It is said that a plant for the working of this process is shortly to be erected on the United Jack mine. (2) The possibility of treating at a profit the large low-grade schist orebodies on the pyritic zone; and with this goes the possibility of these bodies becoming richer in depth.

The Selati railway will certainly stimulate further work and interest in the district. It will also probably induce the expenditure of fresh capital, with good results it may be hoped.

The geological survey made by Mr. A. L. Hall for the government of the Union of South Africa, referred to by the author, is completed, and the Memoir has been published since the above article was in type. We quote herewith part of Mr. Hall's description of the Palabora copper district:

"Scattered more or less throughout the area known as Palabora are a large number of ancient workings, specially prominent over the slopes of Lulu Kop. They are generally regarded as associated with copper ore, and their existence has long been known. Much ground has at one time or another been pegged off, more with a view to future possibilities than as a result of thorough investigation. Attention was again directed to this district during 1911, in consequence of mining operations carried out four miles north of Lulu Kop at the Guide copper mine, since closed down.

"The mine is situated about four miles north of Lulu Kop. The prominent kopjes surrounding the mine are due to rugged masses

of ball-shaped medium to coarse-grained granite and syenite, while the intervening lower-lying slopes or more level flats show occasional outcrops of syenite, varied by smaller ill-defined areas of genetically associated pyroxenite. The whole district consists of a plutonic complex mainly of intermediate and basic rocks, ranging from pure augite-syenite through transitional phases to pyroxenites and traversed by pyroxene orthoclase or orthoclase pegmatites, representing the latest phase in the process of consolidation. While magmatic differentiation has commonly resulted in a definite separation of more normal light greyish-pink syenite on the one hand and deep green basic pyroxenite on the other, we find irregular and smaller patches of incompletely differentiated parent magma, which consolidated as coarsely crystalline rocks mainly composed of pyroxene and orthoclase. The workings of the Guide copper mine are in such an intermediate zone associated with copper-bearing orthoclase pegmatites close to some ancient workings. At the time of the writer's visit this shaft was some 120 feet down, and showed an evenly-medium or coarse-grained deep green pyroxenite. The pyroxenite is frequently traversed by veins of coarse pinkish orthoclase which cut sharply across the parent rock. It is in these later pegmatites that the copper is more commonly found. The ore is distributed in zones of impregnated rock and scattered irregularly through the pegmatites in specks, streaks, or large irregular patches. Sometimes such a zone consists of about one foot of richly impregnated rock, alternating with or passing into another zone several feet thick of less mineralized rock. In certain beautiful phases, the pink pegmatite contains large phenocrysts of orthoclase, $\frac{1}{2}$ in. across, outlined by fresh delicate veins of wider crystalline masses of bright yellow copper pyrite associated with deep greenish-blue peacock ore, now and then forming a kind of network. Near the surface malachite and azurite were found, at a depth of 20 ft. bornite and glance come in, lower down chalcopryite, though bornite still predominates. Little chalcopryite was found at the top. Some crystals show a central portion of brass-yellow copper pyrite surrounded by bright steel-blue peacock ore. The general conditions suggest that the ore forms irregular zones of impregnation genetically connected with the intrusion of orthoclase pegmatite, which probably represents the ore-carrier. No satisfactory indications of a defined lode are seen. For these reasons the distribution of the ore is uncertain."

COALINGA : A CALIFORNIAN OILFIELD

A flowing well, the winning of oil, the machinery employed in prospecting, and characteristics of the industry.

By T. A. RICKARD.

ON a quiet evening last March I crossed the Bay of San Francisco to take the train leaving Oakland for Coalinga, one of the oilfields that have made California as well known for oil as she was previously famous for gold. The crossing of the Bay may have nothing to do with mining and it was an old story to me, yet on a lovely evening in spring it is more than a link with the railway terminal. As the steamboat-ferry churns its way through the placid waters, reflecting the blue of a perfect sky, it is a delight to view a picture not made with hands yet glowing with human interest. In front the Contra Costa hills rise in grass-clad slopes above the plain on which lie extended the towns of Oakland and Berkeley; to the left are islands like those of Lake Como; northward Mount Tamalpais lifts a slumberous head above dark woods; then the Golden Gate is seen, the portal of a continent, and on the southern peninsula rise the serried streets and soaring structures of San Francisco, restored, rejuvenated, and rejoicing, after the disaster of earthquake and fire; preparing for the opening of the canal that is to bring her commercially nearer to the older civilization of Europe, and, as of old, "serene, indifferent of fate" and confident of her high destiny as the metropolis of the Pacific.

When we (Charles T. Hutchinson, the editor of *Western Engineering*, and I) reach Oakland and the train starts, we notice the absence of the familiar puff that accompanies the exhaust of steam from the engine. Instead we hear a muffled roar. As the oil spray is fed to the fire-box of the boiler and there ignites explosively, it makes a sound that drowns the intermittent exhaust of the steam into the smoke-stack of the engine. It was only natural that oil should be the fuel used in generating steam for a train going to an oilfield. I fell asleep that night in the pullman to dream of breakers heard far inland, but woke in the morning to find the train speeding across the arid plains of the San Joaquin valley. It looked like Nevada or Arizona, not at all like verdant California. The sagebrush was rampant and the best land gave only thin pasture for sheep. The San Joaquin valley is not all

like this; it stretches for 200 miles and includes a great variety of pastoral and agricultural tracts. Even these would have provoked no appreciation, however, for the absence of breakfast robbed the scenery of all glamour. It looked like a background for St. John the Baptist doing penance. A little later the foothills of the Sierra Nevada to the east and the lower slopes of the Coast range on the west began to encroach on the plain, giving it a less lonesome air. The Coalinga oilfield is in the eastern or land-ward slope of the Diablo range, about 150 miles southeast of San Francisco, but 296 miles by rail. Soon derricks on a far ridge gave warning of the approach to oilwells. The railway ran through a wide expanse of wheat just emerging in tender green, vivid against the dark purple shadows of mountains in the distance. Suddenly we see a forest of derricks bristling the plain. We pass oil-tanks, varying in capacity from 20,000 to 55,000 barrels, as is indicated by figures marked upon them. A smell of oil pervades the air. We are in Coalinga.

Interest in any form of industry is rendered intelligent by handling the raw material from which the finished product is manufactured. The appreciation of human ingenuity is heightened by contact with the fundamental process by which a mineral product is extracted from the earth. While at Coalinga I saw much that was worth while, but the central episode was the first realization of the meaning of a flowing oil-well. I saw a chocolate liquid issuing out of an iron pipe and passing slowly down a wooden launder. The rhythmic gushes of oil escaping from the pipe suggested pumping, and the reverberating murmur transmitted through the pipe sounded like the stertorous breathing of Nature herself. I put my hand into the oil; it was surprisingly warm, namely 65° F., and as I felt the limpid flow, it seemed first smooth then puckery. This latter feeling was due to the naphtha, which, by dissolving the natural oil of the human skin, causes a sensation like that felt between the fingers after they have been so long immersed in hot water as to remove the oil, which in a savage, unaccustomed to excessive washing, causes his

skin to glisten in the sun. The feeling thus transmitted through the fingers is worthy of mention because, anticipating only the unctuous smoothness of oil, it came as a surprise. This flowing well was No. 15 on Section 34 of the California Oilfields, Ltd., a British company highly successful in its operations. The derrick used while drilling was enclosed by a rough wooden housing and the oil was issuing

near-by where the flow requires mechanical assistance. The launder into which the oil is discharged is like the alluvial miner's sluice-box; it is called a 'sand-box' and has drops or riffles that cause the sand to settle. The oil contains a variable amount of sand brought to surface from the place of immediate origin, namely, a stratum of oil-bearing sand. The iridescent froth floating in the sand-box is due



PANORAMIC VIEW OF

at its own sweet will with no one to watch the operation or to guard the product. Once a well is 'brought in,' the process of winning the liquid mineral becomes automatic mining. The reverberation heard in the pipe and the pulsating flow are both due to the fact that gas accompanies the oil; to the gas is owing its vertical movement to surface. As the gas accumulates deep down in the casing of the pipe, sunk by the drillers, it acquires sufficient pressure to propel the oil, on the same principle as the air-lift used for pumping at other wells

to the churning of the liquid as it is forced upward by the gas. The well was 'making' 750 barrels per day. A barrel is equal to 42 gallons. At the date mentioned a barrel of oil was worth 50 cents. It is oil fit for refining; after allowing the sand to separate, it is pumped through a pipe to Richmond and other points on the coast, from 100 to 150 miles distant. At these ports it is used as fuel by the steamers that go to Japan and Australia, and serves to propel the wheels of industry in far distant lands.

Coalinga is in the western portion of Fresno and Kings counties. The town and the eastern part of the oilfield are in Pleasant valley, while the western part extends over one of the ridges of the Diablo range. The productive belt, so far as tested, is 13 miles long by 3 miles wide. According to Ralph Arnold, who examined the region for the U. S. Geological Survey,* the available oil was estimated, in

ft. of productive sands."[†]

At the station we found an automobile at our service, and after a hurried breakfast, we started to make a tour, under the friendly guidance of R. S. Hazeltine and Thomas Cox. Leaving the town we proceeded northward up the valley; on the left the foothills sloped gently from the coast range, the serried lines of derricks indicating the gentle monoclinial



THE COALINGA OILFIELD.

1910, to be 2,737,000,000 barrels. The output in 1911 was 18,311,251 barrels, out of the total Californian production of 84,000,000 barrels. The prevailing rocks are marine sedimentary strata of Cretaceous and Tertiary age, the most productive formation being the Vaqueros, a series of sandstone beds, 550 to 700 feet thick, at the base of which is found the oil-bearing formation. Mr. Arnold says: "The oil-wells vary in depth from 600 to over 4000 feet and penetrate from 20 to over 200

dip of the oil-bearing strata. The dip is 27 to 30 ft. per 100 ft. The contour of the surface suggests the underlying structure, and about 7 miles north a transverse ridge abutting into the plain indicates the anticlinal fold separating what is known as the West field from the East field. Formerly the intervening tract of two miles was supposed to be barren of oil because the rocks in that locality were known to be steep and broken at the surface, but Mr. Arnold indicated the probability of a

* Bulletin 398, U. S. Geological Survey.

[†] Op. cit., Page 11.

continuity of productive territory. In this he has been amply confirmed by actual drilling.

We move rapidly past successive derricks. They are dark with oil-stains and smoke; the small shanties of corrugated iron at their base afford cover for gas-engines, while the wooden buildings shelter steam-engines. Discarded boilers are numerous, for the gas from the wells is now utilized as fuel for generating power. At the north end of the West field we saw a famous well, now abandoned, called the Guthrie. It proved extraordinarily productive. Incidentally, over 125,000 cubic yards of oil-sand was spread over the adjoining canyon. This well is 1200 ft. deep. The shallowest are about 650 ft., in the northwest corner and the western edge of the oilfield. The deepest is the Mohawk, which is 4300 ft., situated on the lower edge of the anticline. The minimum profitable production is as low as 10 barrels per day at 40 cents per barrel. A well can be operated for \$4 per day. The cost depends upon the frequency of 'pulling,' that is, extracting the rods, tubing, and pumping apparatus, to remove sand out of the well or replace worn parts of the pump. This operation of 'pulling' requires about two days for a 2700 ft. well, but the time expended may range from 6 hours to 6 days.

The original discovery was an oil seepage, spread over an area of 500 acres. The oil had a density of 34° Beaumé. Drilling was started at this spot to 1200 ft., and some of the wells then made are still productive. No mention of the original discovery is made in the Geological Survey's bulletin. This is a mistake. It is always worth while to recount the story of an important mineral discovery, not only for its human interest but also as serving to guide others in the search for similar deposits elsewhere.

Motoring in the bracing air had prepared us for the fuel that generates energy in our own boilers, and we enjoyed, therefore, the hospitality of the California Oilfields, in whose comfortable bungalow we spent the luncheon hour, by courtesy of the manager, A. T. Beazley. Subsequently we visited the flowing well already described. Like many British companies, the California Oilfields has made a pretty settlement, including machine-shops and dwellings for employees. In the tool-shops the visitor sees the great variety of implements required in drilling for a well. The bit itself is a piece of steel 600 to 800 lb. in weight according to the size of the boring. A 12-inch hole requires a bit weighing 1500 lb. The stroke of the beam at surface is 32 inches, the

extent of this movement being spread over the entire series of tools so that at the bottom, or cutting point, it will vary with the stretch, from nothing to several feet. An augur bit is used to clean out a bore-hole. A great variety of 'fishing' tools is kept on hand to extract drills or casing when in trouble, that is, when broken or jammed in the hole.

The use of the automobile is now common in the Western mining districts. By aid of it one can see a great deal in a day. We careered along the bad roads and over the steep ridges as if punctures and accidents were unknown. Our engine was propelled by spirit obtained from a little well on Section 6 of the East field and refined in Coalinga itself. The cost of the motor spirit was 19 cents per gallon. On the road we saw marks indicating the passage of a traction engine; soon we overtook it, puffing hard up the grade. The load is 30 to 35 tons, with three trail wagons. The cost of transport from the California Oilfields property to Coalinga, a distance of 8 miles, is 10s. per ton. But, as my friend remarked, "it plays hell with the road."

The north end of the oilfield is 12 miles from the town of Coalinga. Here the oil-bearing stratum is only 30 ft. thick and is no longer productive. The stratification is exposed in the canyons, the foothills having escarpments at their crest and a dip-slope to the plain. On this wide expanse there are to be seen three big reservoirs for storing oil; they are lined with concrete on the sides and bottom. Two of them, each with a capacity of 750,000 bbl., belong to the Associated Oil Co. and one, holding 500,000 bbl., belongs to the Southern Pacific Railway. The oil is pumped to Port Costa, Richmond, and Monterey in 8 and 10 inch pipe-lines. The plains of the San Joaquin fade into the distant azure, as of the sea. A meadow lark sings gaily.

The standard height for derricks is 84 ft. Near them the leakage of oil has blackened the ground. Those who work at a well are liberally bespattered, yet this occupation, even if dirty, is healthy. When a valve is left in the bottom of a pump and the tube has to be raised or 'pulled,' the oil attaching to it is spilled broadcast, making a tremendous mess. The men's clothes, on being discarded, are placed in a box through which steam is blown, vaporizing the oil and cleansing the cloth. Where the oil has a paraffin base, as in one instance, the rods, tubing, and derrick-floor are sticky with a black paste. The 'adobe' (or clay) soil makes a fairly tight dam for impounding the oil. In drilling it is necessary

to take great care not to allow water to penetrate the oil-sand. The boring is stopped when the last water-bearing stratum, that is, the one known to overlie the oil-sand, and usually 40 to 150 ft. above it, has been reached. Preparations are made to 'take up water.' Cement is pumped into a 3-inch tube passing down the 6 or 10-inch casing, which is plugged at the top so that it becomes a cylinder closed at surface but open at the bottom of the bore-hole

done not to one well only but to the adjoining property. Carelessness in this matter has already injured several oilfields, for the water entering the sand will drive out the oil and prevent its subsequent recovery.

The wells flow by 'heads,' that is, intermittently, at intervals of several minutes or even hours, according as the gas accumulates and lifts the oil.

The machinery applied to the winning of



and full of water. As the cement is forced to descend and rise on the outside of the pipe it displaces the water and makes a tight lining. All the excess cement is driven out of the pipe and the casing is then lowered to the actual bottom and allowed to rest for two weeks, while the cement sets. The hole is then bailed to ascertain if it is water-tight. This work must be carefully done; if not, an injury is

oil is of the simplest type; to a metal miner it seems crude. A 23-horsepower beam-engine is in common use for drilling and pumping; it has a cylinder of 10½ by 12½ inches and consumes steam lavishly. However, it suits the drillers, who fight shy of any delicate or complicated mechanism. The tall derrick and the walking-beam of the lift-pump remind one of the engine-house and pump-bob of the Cor-

nish tin mines. The walking-beam, which transmits the power, serves also to lift the rods attached to the drill-bit or the pump-piston. One man can watch 4 steam-engine pumping-plants if they are not far apart; and if gas-engines are used, he can attend to 6 such plants. The pumps have a ball-valve. I saw a 'pumping jack' or big eccentric with wire-rope connection radially to 7 pump-bobs, operating 7 wells. Under such conditions it is profitable to pump wells yielding only two barrels of oil per diem. The local water is 'hard,' and is treated with lime and soda ash to soften it before use in the boilers. Wells are drilled 150 ft. from all boundary lines, by general agreement, the intent of which is obvious. No man is to be seen about the machinery. It is automatic in the fullest sense. Another interesting point is the fact that many wells provide the gas, for fuel, required to pump the oil. For a long time the gas was wasted and oil was burned under the boilers. It escapes through the annular space between the tubing and casing.

The well records are kept carefully by the best managed companies and afford valuable data in regard to the local stratification. As regards the cost of drilling, it may be said that well No. 1 on Section 20 cost \$65,000 to sink and equip to 3300 ft. This work was attended with some ill-luck; ordinarily \$40,000 would suffice.

On our way back to the railway station, after five or six hours of hasty inspection, I remember seeing oil and sand in big blobs issuing from a pipe into a dam. I saw oil gushing spasmodically out of another pipe on to a flat cone of dark sand. I watched a hole in process of being drilled with apparatus that seemed to me in peril of collapse. The rain overtook us and with it came a colder air that caused each jet of exhaust steam to be plainly visible, so that each dark derrick was feathered at its base with a white streamer of steam. This emphasized the wasteful use of steam in the winning of oil and left a final impression that the exploitation of the oil resources of California was an intensely interesting and profitable, but withal, a most extravagant, business.

The Venezuelan mining code provides that one-third of the net proceeds of a mine shall go to the owner of the surface ground. This has been a serious obstacle to the investment of foreign capital. The Supreme Court has now declared that this provision is unconstitutional.

The Giant Converter at the Great Falls plant of the Anaconda Mining company continues to be a source of both astonishment and satisfaction. The *Mining and Scientific Press* reports that the latest results show a production of 52'3 tons of copper in a single 'blow,' the total time required being 8'5 minutes per ton of copper, or 6'1 minutes actual blowing time per ton of copper. This is at the rate of over 200 tons of blister copper per day from a single converter. A better conception of this enormous converter may be derived from the statement that is considerably larger than a good sized room, that air is blown into it at the rate of three-fourths of a ton per minute, and that a single charge yields a car-load of blister copper. The advantages of the upright, or Great Falls, type of converter have been slow in finding recognition, but it is now being employed for new construction in a number of plants in the Southwest and Mexico. This 20-ft. converter further demonstrates that, in addition to first securing a proper coating upon the basic lining, the essential feature of successful operation is temperature-control, which is the more easily secured the larger the mass of hot material that is handled. The heat lost by radiation and carried away by escaping gases is of less importance in a large converter, while the opening at the mouth renders it possible to add unlimited quantities of cold material to keep the temperature down. Much of the trouble formerly experienced in the operation of converters was probably due to using too small a mass of material; just as, for example, a tack-hammer would be ineffective in hand-drilling.

The Freeport Sulphur Co. is about to begin production at Bryan Heights, Texas, a fact which attracts renewed attention to the 'domes' from which gas, oil, sulphur, and salt are being won. Gilbert D. Harris has described these domes in much detail and has explained them as due to the upward thrust developed by salt crystallizing when deposited by artesian water returning to the surface along the intersections of crevices. Credit for recognition of their economic importance is due to A. F. Lucas, who was the moving spirit in pioneer drilling at Spindle Top. Before others were ready to believe that these insignificant mounds, which rise but a few feet above the surface, had any structural significance, he became convinced that they were genetically related to petroleum. Hermann Frasch was another who won fortune from these domes, at the same time enriching the technology of the sulphur industry.

DISCUSSION

Our readers are invited to criticise anything appearing in this magazine and to discuss other subjects of general technical interest.

The Engineer in the Tropics.

The Editor :

Sir—Will you allow me a part of your space to make a few remarks upon the article by Mr. T. Lane Carter and your editorial concerning 'The Engineer in the Tropics.'

It is, in my opinion, the engineer and the military officer who should profit most fully from the recent discoveries regarding the origin and propagation of the specific diseases of the Tropics. A little consideration will convince your readers that there is a remarkable similarity between the conditions under which these two classes of men work. The efficiency of each is often diminished by losses of men, and consequently of money, from causes which we now know to be easily preventable. No better illustration could have been given by Mr. Carter of the relation between the science of medicine and that of engineering than the remarkable results obtained by Colonel Gorgas and the engineers employed upon the Panama Canal. But, indeed, no illustration is needed. It has long been obvious that where leaders of men—soldiers and engineers—have made themselves acquainted with the progress of medical science, a practical application of recently acquired knowledge has given efficiency results of immense importance. Sanitary administration now rests upon a sure scientific basis. The work of Manson, Bruce, and Ross is not merely suggestive of possibilities of engineering work in tropical countries hitherto deemed impracticable; administrative work in the Army of India has supplied the proof that a knowledge of the discoveries of these and other men is an essential part of the equipment of soldiers, and consequently of civil and mining engineers. The modern military or engineering commander of men who is ignorant of the etiology of enteric fever, of cholera, of malaria, and of many other diseases that are especially the diseases of camps and works, most assuredly will pay that heavy penalty which is the consequence of ignorance and folly in all the relations of life.

Mr. Carter has dealt with these matters in so far as they relate to personal hygiene in the Tropics. He has shown himself to be well acquainted with his subject. I venture to think that he might with equal success have demonstrated to his professional brethren how closely their administrative work is bound up with disease prevention.

I would not have ventured to address you on this subject had I not been of opinion for many years past that ignorance of sanitary science (gradually widening until it may now be said to include almost every disease specially interesting to the administrator) on the part of those responsible for the maintenance of the strength of bodies of men, cannot longer be tolerated by public opinion, when public knowledge has been sufficiently wide-spread. I have never hesitated to express the belief that since the etiology of tropical diseases is a subject of special interest to engineers and to military officers, they should obtain a special training and education suitable to their needs in this important subject.

It may interest your readers to know that attendance at lectures on this subject is now obligatory for all engineering students of the Imperial College, and that last session these lectures were delivered by Colonel Melville, the Professor of Military Hygiene in the Royal Army Medical College. These lectures were of a kind similar to, if not identical with, those now given to all officers of the Army in garrisons, and to the students of the Royal Military College and Royal Military Academy. They serve a useful purpose, but not until civil and mining engineers with tropical experience come to recognize how closely a knowledge of tropical diseases is related to their work as administrators will it be possible to ask that the doors of the London School of Tropical Medicine shall be thrown open to students of engineering.

ALFRED KEOGH.

London, September 12.

Phantom Profits.

The Editor :

Sir—Tersely stated, in any money investment or speculation, the 'profit' is that amount which remains to the good after the replacement of the original sum invested, plus interest. 'Estimated profit' is that amount which it is considered will be, or ought to be, to the good, if everything eventuates as calculated.

In these two axioms are the gist of the discussion. Most statements of 'profit' in mining are, of necessity, an estimate of profit, but some are more estimated than others. It is the degree of 'estimation' that requires watching. Directors of mining corporations have shares to sell and they must perforce dress their wares in as attractive a fashion as possible. Furthermore, they must—for the benefit of investors—discount somewhat the possibilities of the future and, in short, they must

at all times be prepared to hold out bright hopes of large profits ahead; otherwise there would be no investors. This condition applies not only to directors of mining companies, but to most enterprises. It is in this spirit that glowing statements and figures are made dealing with both current operations and future prospects, and not infrequently it appears ultimately that those responsible for the statements have been—to say the least—too optimistic. Hence the apt creation of the term 'phantom profits.'

The two points round which this controversy revolves are the method of book-keeping when dealing with current accounts and the forecasting of future returns. The market-value of shares depends on these two counters.

In the history of every mine there is a preliminary period of exploitation, development, and equipment. This is followed by the productive stage, and finally comes the closing-down or exhaustion. Obviously, in the first stage there must be outlay on capital account; in the second stage there may be further outlay on capital account in addition to working account; and in the third stage there should be nothing but working account.

Estimates of the cost of equipment and development are apt to be much lower than the actual expenditures; in fact, it may be safely stated that they are usually lower. Unforeseen items find their way into the statement, and probably always will. This fault is not confined to mining; it applies to most things. Anyone who has had experience in the building and furnishing of a residence for his own use will probably have good reason to agree with this statement. And, after all, it is only human nature to take an optimistic view of these matters. The mining engineer who would dare to investigate the amount spent on capital account in a venture such as the Homestake, for instance, with the idea of using the figures as a basis for future calculations, would, if he carried his ideas into practice, be committing professional suicide.

The Homestake mine in the past twenty years must have appropriated millions of dollars from profit-and-loss account in outlay on items that by many directors would be credited to capital account, and if these amounts had been included in the original estimate no financier would ever have faced it. The Homestake is a colossal mine, however, and has proved its ability to meet these charges as they arose, and every producing mine must to a degree, consistent with its own peculiar conditions, be prepared to face such contingencies.

If the mine is as good as the Homestake, the difficulty is met by similar appropriation, otherwise the capital account continues and fresh drafts have to be made on some source or other to satisfy the demand.

It is a notorious fact that development, for instance, costs a great deal more per ton of ore developed when a mine is in the non-producing stage than when it is in full swing, and the explanation is simply that the distribution of standing charges in the latter case is made over a great many more accounts, thereby automatically reducing the debit to development. In other words, when only development work is being carried on, the whole of the underground charges to Compressor, Pumping, Hoisting, Lighting, Timbering, Supervision, and general underground charges must go to Development; whereas when mining begins, the cost is distributed over the two accounts. It follows, therefore, that the development cost of the first tonnage of pay-ore in the preliminary period may be several times as heavy per ton as in the later stage. This fact is apt to be overlooked in preliminary estimates.

Having completed the development and equipment to the point when production is to begin, the second stage is entered. It is here that trouble begins. The question arises, should all subsequent expenditure be allotted to working account, that is, to profit-and-loss account, or should the capital account be allowed to continue to meet outlay on additional new plant or extraordinary development? In the handling of this point we find most of the differences in mining accounts. Many of the brightest men to be found in the list of directors, auditors, financiers, and engineers have grappled seriously with this problem for years, and I have personally had innumerable discussions on the various phases of the question, particularly during my association with Messrs. George and Leopold Albu on the Rand. In fact, it may be said that the heads of all the big South African houses have for the past fifteen years devoted a great deal of attention to the proper solution of this problem, so that whatever generalization may be reached from an academic standpoint there will be found, in opposition to it, weighty factors of practical import as between mine and mine.

If a company starts with unlimited capital and carries its policy of equipment and exploration to a point that will see it through many years of production without any danger of a call for heavy renewals of plant or excess development, then the position is simple. But if, as so often happens, the original capital

proves to be equal only to a haphazard start, with all sorts of items still to be met, then the position is reversed. Or again, if there is a big surplus of capital associated with a high-grade mine and a concomitant big margin of working profit as compared with a shortage of capital and narrow margin of profit, the policy that could be suited to the first case would spell utter ruin when applied to the second. In this, therefore, I sympathize with the director who is honestly striving to work out the salvation of a mine coming within the category of the last-named class.

The objection to the granting of any latitude in such a case, however, is its abuse by those of unscrupulous tendency; while even under the most careful administration, the returns may be made to flatter the real capabilities of the mine.

The accounts that most readily lend themselves to abuse are the Development and the Permanent Works account. Once the principle of dissociating these two accounts from the statement of working expenses is permitted, the temptation to a manager to soften the effects of a bad month, by transferring to them items of every-day cost, becomes in time almost irresistible. If the manager is willing to take advantage of the position, it is exceedingly difficult to check him. On a mine doing 1000 feet of development per month, the cost may in divers ways be artificially increased, say, 5s. per foot or £250, and this amount could be so obscured in the various charges as to escape a challenge. The explanation would be "hard rock" or "inefficient labour," etc. 'Mining' could thus be reduced. This is rendered possible by the use of the development-redemption charge, an arbitrary amount debited to the cost of every ton milled and supposed to reflect the *average* cost of development. There is no doubt that on many mines this arbitrary amount has been grossly underestimated, with the result that the working cost has been reduced artificially to a figure considerably below the actual, while correspondingly a 'profit' has been declared that never existed. Such a condition may arise even when the intention has been strictly honourable, by over-estimation of the ore developed during any given period.

I have known of a case where out of over 400,000 tons of ore standing to the credit of the development account only 5% proved upon examination to be profitable. Against this tonnage stood a large amount that had to be written-off as loss, and the company had to be reconstructed. The statements issued by that

company over a long period had shown profits, which, in view of this loss, had never existed; yet its shares had been bought and sold freely on the strength of these statements. There was, and still is, no question of the honesty of the directors, but had the principle of the development-redemption charge never been admitted, this glaring error could not have happened. On the other hand, I know of cases where the arbitrary development charge has proved much too high, resulting in the accumulation of a large tonnage of ore standing in the books at no cost. This, too, is an error not to be approved, but certainly not to be criticized as harshly as the first case quoted.

A moment's consideration will serve to show that in the nature of things no arbitrary charge can be correct; it may be too little or too much, but unfortunately it is generally the former. On the other hand, it is reasonable to charge to working cost in the producing stage the amount per ton for development that was incurred in the preliminary non-producing stage? Manifestly not, as the current cost of development would be much less, provided the orebody maintains the same characteristics.

To meet this difficulty it has been the custom of some companies to charge to Development whatever may have been spent in the particular month under consideration, but even here arises the danger that having a large accumulation of development work in hand the monthly development tonnage may not be equal to the ore extracted monthly. That is, the original accumulation would be spread over a subsequent period—varying according to the magnitude of the original tonnage developed—as a bonus to working cost. Eventually this accumulation would disappear and the true figure would then come into force, but in the meantime the working cost would be presented at a fictitious figure, and a mine starting with a huge accumulation, as compared with another with only a small tonnage in hand, would be unfairly represented in its monthly statement.

The logical and correct method of meeting all these difficulties is by a capital-redemption charge—that bugbear of all mining finance. From the banking or commercial point of view the claim for a redemption charge, to be included in the statement of profit-and-loss, is unanswerable. It meets alike and on a fair basis the case of the company that starts with a big surplus of cash and the other that has too little; it demands satisfaction for every sovereign spent on capital account in proper proportion to each ton of ore taken out of the

mining asset; and rightly so. A mine is a wasting asset; every hundred tons extracted leaves it exactly that much the poorer, and it requires its quota of cash back. But again we are confronted with a difficulty: who is to say what tonnage the mine contains and over how many years it will continue to produce? We have seen that in the case of the mine-redemption charge the fixing of an arbitrary figure is sure to be too much or too little, and the same law must apply to the fixing of a capital-redemption charge. Having conceded that point, must we admit that the rate shall not be fixed? Is it better to allow capital-redemption to remain a gambling counter, the chances of which are to be left to the judgment of those who can have few real data on which to fix it—I mean the average shareholder—or shall we rather insist that those who should best be able to fix a rate and whose business it should be to do so, shall do so, knowing that it can at best be only an approximation? Would it, in fact, be wise to establish a sinking fund on a basis that may favour posterity and prejudice present shareholders, in the full knowledge of the dangers of that policy and the possible magnitude of the error?

A wise man, a provident man, or a careful business man, could really have only one reply to this question, and yet we have many shareholders who are apparently content to ignore the very principles that their own judgment must tell them are the only sound ones. Are directors to be blamed, therefore, if they avoid this responsibility when the shareholders, men of every profession, are satisfied to proceed without them? Why should they?

Of course these principles are only required in an industry and in a solid investment. They cannot be applied to a business that is intensely speculative. And herein is the crux of the question. There is the high-grade narrow-bodied bonanza mine of immense fluctuation in value, and there is the wide-bodied, steady-going, low-grade mine of practically no fluctuation, so different in characteristics whichever way they be regarded as to involve entirely different financial elements. The director of companies not unnaturally cites this variability and not unfairly asks: "Who am I to apply bank laws of amortization indiscriminately to these cases? let the public be its own arbiter; let the public figure out redemption to its own satisfaction; and let the public buy only the shares that it wants, after a due consideration of these factors. I refuse to take the responsibility."

You, Sir, draw attention to the fact that statements of monthly profit find only a part representation in dividend warrants. You might go further and show that dividends even may by subsequent events prove to have been unjustifiable, that they were not actual distributions of profit, but merely replacements of some of the capital launched.

Perhaps this statement requires some explanation, and I take the following instance to illustrate my meaning. A mine is shut-down, having encountered low-grade ore-zones resulting in a depleted exchequer. The company is reconstructed and a sum of £100,000 is provided for development purposes. At the end of 12 months the company resumes production and for a further period of 12 months milling operations are steadily conducted. A profit of £7500 per month is declared and the company in that period distributes dividends to the extent of £60,000, when it is again forced to close-down for lack of funds. The net result of the reconstruction is thus a loss of £40,000, despite the fact that so-called profits of £7500 per month have been declared. The sinking fund for the short period of 12 months to redeem £100,000 would amount to more than even the declared 'profit.' This is an exaggerated case, but it serves to illustrate the point.

It has been suggested by one writer that all capital accounts should be closed when a mine reaches the producing stage, and all expenditure thenceforward be charged to profit-and-loss account. If, subsequently, further capital should be required, it must be raised by the creation of new shares or debentures, thus increasing the capital liabilities, but monthly statements of profit-and-loss should still include all expenditure unless there be duplication of plant or something of that nature obviously chargeable to capital. Compromises of this nature, however, are merely begging the question of capital-redemption by means of amortization.

The effect of the inclusion of the amortization charges in the statement of profit-and-loss would, of course, in numbers of cases, be appalling. Take the case of a mine that has spent £100,000 on purchase of property, and £200,000 on equipment and development, making a total of £300,000, inclusive of compound interest during the non-productive period. Take the life of the mine at 10 years and the amortization of capital at the rate of 3%. Assume further that the company begins to produce and shows a profit of £6000 per month throughout the period. The demand

for amortization of the cash working-capital would, on this basis, amount to £2180 per month, leaving a balance on working account of £3820 per month or £45,840 per annum. Assume the capital of the company to be £500,000, then the rate of profit would amount to 9% on that capital after providing for replacement of the cash working-capital. In mining we look for 10% on par value and therefore our profits fall short of the required amount by £4160 per annum. The shares therefore on the basis of 10% are worth under par, even without allowance for amortization.

The market, however, views the matter differently. £6000 per month amounts to £72,000 per annum. Assume that the whole of this is available for dividends: the market treats this as being equivalent to $14\frac{1}{2}\%$ and the shares are therefore rated at from 35s. to 40s. On the basis of £72,000 per annum, and allowing 6% for dividends and 3% for amortization, the present value of these shares is 19s. 6d. only.

It must not be forgotten, however, that there are many mines—the Meyer & Charlton, for instance—that have replaced their capital many times over, plus a handsome rate of interest; but not many could so easily respond to the test. It comes to this, that the really good mines that are not over-capitalized could easily enough submit to the inclusion of the redemption charge, but the really bad mines would make a sorry showing.

As before stated, I sympathize with the efforts of the director who is honestly doing his best to bring salvation to a poor and difficult mine, and I would not be too eager to hamper him with regulations that might spoil all his chances of legitimate success. There are periods of anxiety in the history of the best of mines, and some startling results have been obtained on the Rand in the past 10 years on mines that at one time appeared to be hopeless.

Mining is not a banking business; its whole history is eloquent in support of this statement. The promise of profit has to be great, and fortunately there are numerous cases where even the promises have been exceeded beyond all reasonable limit. Is it to be wondered that there are many more where these promises have been unfulfilled? While the instances of success continue to multiply, so long will the public be lured into the investment, and they do it with the privilege of keeping their eyes open.

The day may come when the inclusion of the amortization charge in the profit-and-loss

account will be required by law, but that day is yet a long way off. In the meantime it behoves you, Sir, and your brethren in the profession of technical journalism to see that, in those cases where the principles of honesty are abused, the persons responsible are called to account. In this direction there is a wide field. Much can be done to alleviate some of the dangers to which you have called attention, and certainly the difference between the monthly statement of profit and the annual dividend should be, can be, and must be, narrowed to a small margin.

H. S. DENNY.

London, August 28.

The Editor:

Sir—The subject of 'Phantom Profits' now being discussed in your magazine recalls a conversation we had last year. There is no question that shareholders are primarily interested in the profit that will be distributed in dividends. To view the subject from any other standpoint is an evasion of the issue. I think, however, there is a distinct difference between the profit dealt with by a valuing engineer examining a property, and the statement of profit that should be delivered by the administration of an operating mine. The observation of Mr. W. H. Goodchild as to the necessity of qualifying different kinds of profit is, in my judgment, well taken. The valuing engineer can only deliver judgment competently on operating profit. To expect him to introduce a factor of head-office expense and capital account, which latter may be dealt with by others under varying methods, is in my opinion unreasonable.

Last year I examined a large producing property where the accounts were excellently kept by the mine-accountant. The company-books lay at a head-office, and were audited annually by Price, Waterhouse, & Co. I considered that I fulfilled my obligation in dealing with the present operating profit at the mine and delivering judgment on the possibility of increased operating profit to be expected from a more efficient policy and larger-scale operations. The dealing with overhead charges, which were not part of the expense at the mine, and the allocation of them to capital account, I considered a responsibility to be assumed by the auditors and the board of directors. I was later employed to report on a property that was privately owned, as a phase precedent to placing the enterprise on the market. I considered my responsibility as an engineer lay in dealing with the probable opera-

ting cost at the mine, in the light of my experience with other properties similarly situated. My report was unfavourable, but this fact does not alter the value of the example. I therefore submit that the valuing engineer, when employed to report on mines in the administration of which he has no control, can only be expected to deliver judgment on operating expense and operating profit, and the capital outlay necessary to bring new ventures to the productive stage. This duty and that expected from consulting engineers and the directors of operating properties are distinct propositions. I respectfully submit therefore that these phases should be considered separately in a discussion of this kind.

MORTON WEBBER.

New York, September 10.

Premature Precipitation.

The Editor:

Sir—A perusal of Mr. D. F. Foster's note in your June issue fails to convince me as to the inertness of charcoal and organic matter in the cyanidation of silver-gold ores. Whether or no it is only correct to use the past tense when referring to the use of charcoal as a precipitant I am in no position to speak with certainty. Neither is Mr. Foster. In any case a settlement of the question would not affect the argument one way or the other.

Mr. Foster says: "In Mr. Allen's calculation of 76% extraction of valuable contents he forgot to reckon the gold. Had he calculated the gold and silver content together he would have found an extraction of 85% had been obtained." As a matter of fact, I seem to have done exactly as Mr. Foster advises, but still not as he would wish. The original gold and silver content was 9.2 oz. The residual gold and silver content was 2.16 oz. This indicates an extraction of about 76%. By calculating the percentage extraction of the gold and silver separately, adding them together, and dividing the result by two we get 85.5%, which is an average of extractions without being an average extraction; and is a figure which has no more bearing on the question of the solution and precipitation of the metals than an average of assay results would have in a calculation of average metal content in ore reserves. On the other hand the extraction in terms of current metal value amounted to about 84.5%, a figure which would vary with market fluctuations and one which would, consequently, be outside consideration in a question dealing with the purely metallurgical side of the matter. The positive statement that the gold was

overlooked in my calculations is erroneous.

The solubility of zinc in plant solution would depend on the quantity of zinc already in solution, the amount of metal to be precipitated, and the amount of free cyanide present. In the instance under review there is no reason to assume that zinc would disappear with more rapidity in an agitation-vat than in an extractor-box; or that the compound formed would consist solely of the double cyanides of zinc and potassium, as Mr. Foster suggests.

A. W. ALLEN.

Inyati, Rhodesia, August 10.

Prospecting.

The Editor:

Sir—In your issue of September, page 219, line 13, first column, should read: "from which veins *nary* [not *many*] a colour," etc. This will be obvious to anyone who read the original article.

STEPHEN J. LETT.

London, September 21.

Cornish Methods.

The Editor:

Sir—Being a Cornishman, and interested in the welfare of Cornish mines, I have read with much interest Mr. Edgar Rickard's paper in your August issue on 'An Excursion in Cornwall.'

Mr. Rickard's contention that the vanning-shovel method of assaying is entirely out-of-date, and unreliable as a method for the determination of the tin in an ore, meets with my approval, although Mr. A. E. Thomas's remarks, quoted by Mr. Rickard, "that we as mining engineers are more concerned with the quantity of tin in the ore than our present appliances can extract" no doubt deserves more consideration than at first appears to the outside mining engineer unacquainted with the difficulties of tin-dressing. The inadequacy, however, of the vanning-shovel method is freely acknowledged by many of the Cornish engineers, as is amply proved by their adopting the chemical method, and estimating their extractions thereby.

At a mine with which I was intimately acquainted some years ago, and where the vanning assay was the only method of estimation, the actual weight of the tin sold to the smelter over a considerable period, after the usual deductions had been made, as explained in your issue of May last, by Mr. H. E. Fern on 'Tin Ticketing,' represented over 100% of the actual contents as determined by the vanning shovel, although it might be added that the waste pro-

duct flowing down the river to the sea was a source of considerable revenue to the lucky 'streamer' who happened to have the monopoly of that impoverished product.

To demonstrate the unreliability of the vaning method, I recently divided one sample of 6% ore into three parts, and sent a portion of each to three different assayers for assay; the results showed a variation of 0.3%, whereas the remaining portions when assayed by three different assayers gave a variation of over 1%. The highest recovery of any of the six different assays mentioned above was 70.25% of the actual contents of the ore, as determined by the chemical method.

Another comparison between the chemical and vaning methods was made on a highly pyritic ore, the chemical analysis showing the ore to contain 2.6% tin, while the vaning method gave the contents as 0.3%. The assayers in each case are at present employed by different mining companies in Cornwall.

When dealing with the labour question, Mr. Rickard most aptly described the position when he wrote: "So long as a system exists whereby the prices and payments for contracts are restricted by, or based on day's pay, and not solely and entirely on the amount of work actually accomplished, the best men will continue to leave the County for foreign mining fields." There is an old system still persisting in many of the mines throughout the County, whereby the earnings of men employed are based on the amount of remuneration received by them for the previous month, having little or no regard to the amount of work performed. This system has made the miner an indifferent worker; has put the little things of life, that would tend toward the comforts of his home life, beyond his reach; and has ultimately driven him to other mining fields, where his services can be more readily recognized; with the result that today Cornwall is practically a training ground for young miners, who, as soon as they feel themselves capable of performing a day's work, go to join their friends and relatives in other parts of the world.

It is cheering to note that at Carn Brea & Tincroft, the management has tackled the position, and by the encouragement of individual labour under equitable terms, has been able to increase the average wage by 50%, and at the same time the working costs have been lowered.

In support of Mr. Rickard's contention "that better pay for the worker, and more efficient service are factors which alone will solve the

labour question," and also to substantiate the results obtained at the Carn Brea & Tincroft mines, the following figures are given. They represent the results taken over a period of 8 months during the year 1910, showing the cost per ton of ore mined, and the average wage paid per man over the same period, at a mine with which I was at that time intimately acquainted.

Cost per ton of ore mined.	Average wage per man per week.
10s. 10d.....	23s. 0d.
11s. 7d.....	23s. 2d.
10s. 8d.....	21s. 6d.
8s. 9d.....	24s. 0d.
8s. 9d.....	24s. 0d.
8s. 0d.....	25s. 4d.
5s. 6d.....	28s. 4d.
4s. 9d.....	27s. 8d.

T. HENRY PRISK.

St. Agnes, Cornwall, September 6.

Efficiency.

The Editor :

Sir—Your magazine is usually so conspicuous for the clearness of its conclusions, the soundness of its science, the attraction of its arguments, and the broadness of its view, that to criticize your articles is not a duty; it is a pleasure. But *aliquando bonus dormitat Homerus*, and the article in your September number is quite another story.

I agree that "the day of the amateur fozzler" (the correct expression is a 'foozle'—a tedious person; a fogey) "in business and technology is gone," but I entirely disagree with the title of your article, for you assume that efficiency and specialization are, of necessity, synonymous, an assumption not only fallacious but dangerous.

I pass over your dogmatism about British sport with the suggestion that if you had read the report of the British Olympic Council (issued, I think, after your article appeared) you would no doubt have accepted the view of *The Times*, that it is a vastly better document than that rather aimless and apologetic interim report first issued, and upon which the newspaper discussion, to which you refer, was founded. If, in the same way, you had read a recent article in *The Times* on 'The Business of Golf,' you might, perhaps, have modified the moral you draw, for you would, I am sure, with these documents before you, have agreed that instead of Britishers thinking their way of playing games is the best, and that they are too apt to expect others to play a game in the British way, the opposite are the facts, for, although the British have, to a great ex-

tent, imposed their way of playing games upon the whole of Europe—and shall we say the American continent too?—Britishers are far from blind to the spur of foreign competition; indeed, the moral properly to be drawn from the experience of Stockholm is not specialization, but the necessity for eternal vigilance, the price of competition.

Specialization without efficiency is worse than useless: it is positively dangerous. Even efficiency and specialization combined are valueless in business without thoroughness and adaptability, and it is just in these two attributes where Britishers are far ahead of Americans.

Passing, reluctantly I admit, over a good many of your points, I come to the assertion that in business the Britisher is a bungler. I take unqualified exception to such a statement. If he be a bungler, how is it that "British capital not only irrigates the waste places of the Earth, but it aids enterprising men in every corner of the globe" (see *The Mining Magazine*, September 1912, page 167). If the Britishers are bunglers why do so many Americans bring their schemes to Britain to find capital? Britain, particularly England, is by universal consent recognized, especially by the United States, as the Mecca to which all good (and other) Americans bring their projects (good and otherwise) for exploitation when they want money, in the hope that the Briton will find the sinews of war. No, the British have many faults, but bungling in business is not one of them; they are the greatest commercial nation in the world.

To paraphrase an extract from the Olympic report, above referred to, it may be said that Great Britain still possesses as good material as other people, while noting the fact that other nations may be thought to stand in front of her, seems to suggest to the minds of some that too much emphasis may be laid on concrete successes as apart from general well-doing; and that possibly a most interesting symptom is the wonderful advance made by other countries toward Britain's own ideals in those matters that we still seem too apt to take for granted as peculiar possessions of our own: there is not, perhaps, so much matter for self-congratulation in the fact that for many years before our work was thoroughly appreciated outside, we were continuously able to beat the foreigner. The weapons are now more nearly equal, and Britain must, and does, recognize that movements to which she has given their permanent characteristics are going on with irresistible momentum.

There are certain instincts strongly developed in Britishers, namely, a reverence for facts, and an appreciation of precedents. No doubt, when these instincts are more fully developed in America, its people will better appreciate that the mighty fabric of British prosperity would, to use the words of an accomplished journalist, vanish like a mountain mist, if Britons were to follow the practices of some other countries. As Goethe wrote, nearly one hundred years ago: "Wealth and rapidity are what the world admires, and what everyone strives to obtain"; and so it is today: successful men, including Americans, are people of quick perception, adroit, and with an unerring sense of the possibility of making money, by the combination and exploitation of various incongruous elements. Some people call this 'hustle,' some 'American intensity'—you name it "splendid." And so it is, but at the same time, it is a quality not unknown to Britishers. Let me give you a good definition of an American: "the finest commercial sportsman in the world." It is not my own, and as it recently headed an advertisement appealing for \$25,000 quickly, "in order to make \$1,000,000 in three years," the definition may not be above question.

To descend from generalities, and to particularize, it was the fashion a few years ago to say that Britishers couldn't build railway locomotives. Do you remember the history of the American built locomotives brought to this country and how they were scrapped? Also that they couldn't build railway cars. Do you ever travel in the American built cars on the underground? To come right up to date, even the great Panama Canal had to come to Britain for its big dredge.

Are Britishers really bunglers? No. Your suggestion that they are "bunglers" is not one to be argued; there is only one course: it should be withdrawn.

Your second point to which I refer is that British operators are compelled much too often, in dredging, to call for the advice of an American. I leave it for others to comment upon such a necessity in the cases of economic geology and copper smelting, others who are "specialists" in these branches, and I will confine my observations to dredging, speaking only of that which I know. And I would first ask the questions: Who originated dredging for minerals? Who successfully developed it? How many American "specialists" are men of practical dredging experience in countries outside the North American continent? and how many of them have made, in any other

country, technical and financial successes?

I will undertake for every one such American to find ten, or even more, Europeans, including Colonials, and a few Dutchmen. I will give you Colombia, Peru, the Argentine, Guiana, West Africa, yes, and will throw in Burmah and Siberia, and ask you to give me a single instance in any one of these, or other, countries, outside the North American continent, where an American dredge specialist, be he designer, builder, prospector, financier, or

favour: at home, good climate, long season, good ground, proximity of repair-shops, easy labour; and what is its history in a few words? Company incorporated in 1905; paid four or dinary dividends, aggregating in four years some 37½% altogether; ceased to exist in 1909 as an American company, with a deficit of \$62,911, and had to be brought to London to get capital, and to exploit its Pato proposition.

To be sure, just as our cricket-fields are credited with winning us Waterloo, so Oro



DREDGING ON THE INOUBRA, WEST AFRICA

promoter, or all combined in the one, has made a success. And I could show you in at least some of those countries, monuments to the inefficiency of the American dredge specialist.

But I come nearer home, and ask what has been done in the United States? Take Oroville, the crack dredging proposition of the world—at least that is what it was generally accepted as by those not better informed—a dredging proposition with everything in its

ville may have been the base-ball field on which was acquired, to use your words "at the expense of the shareholders"—and a pretty big expense too—the experience and knowledge for Natomas. By the way, who "bungled" the capital for Natomas Consolidated? I rather think the Britisher did.

Specialism is all very well if founded on actual practical experience, but just as in medical practice, so in mining or engineering, it

may be in danger of being carried too far; while all specialism of study, one-sidedness of view, and division of labour, we have it on the authority of a recognized American writer, is dangerous; just as dangerous if carried to excess as was standardization in the early days of American dredge building. Specialism in America is too quick; in England it may be a bit too slow, but it is safer.

Specialism is, after all, a groove of comparatively narrow dimensions in the profession of an engineer, who may be defined—I like the old fashioned British definition of his profession—as one working for the promotion (no connection with your offending promoters!) and acquisition of that special knowledge which is the art of directing the great sources of power in Nature for the use and convenience of Man.

It is quite true that some British consulting engineers, and dredging companies, have called in the advice of American specialists. It would be interesting to know the experience of, especially, the British dredging companies in this direction.

An American as I am, it would ill-become me to say that the Americans are a great nation: but about that there can be no doubt. The Americans, further, in their shrewdness have appreciated the economic value of specialization, and their absorption of general instruction in student days is, as the Olympic report says, after all, very good ground-work, but it is no good, and of no real practical value, without actual experience. It is also a truism that the British are a remarkably patient people, but is it quite cricket, or even baseball—a game, after all, not original but evolved from an older British game—to seek to compare the two nations more especially in business, and particularly in dredging affairs, *always* to the detriment of the Britisher?

A. C. SCHONBERG.

London, September 26.

[Mr. Schonberg is entitled to his say, and he says it in an interesting manner. It is fair, however, to point out that he enlarges our argument in order to tilt more effectively against it. We did not make any such large statement as “in business the Britisher is a bungler.” What we did say was: “Unfortunately the American brings his intensity and concentration into sports only to spoil them, and the Britisher introduces his casual indirection into business only to bungle it.” We let it go at that.

Mr. Schonberg implies that no dredge built or designed by an American has been successful outside of the American continent. He

over-states his case. What is the matter, for example, with the dredge now at work on the Kolchan placer, in Eastern Siberia? Oroville is an unfortunate example. As a flotation, it was a bungle, for the British were invited to come in on an upper story instead of the ground-floor and they accepted the reports of honourable gentlemen who were participating in the business, instead of obtaining the advice of detached engineers. The last sentence of our contributor's letter conveys an idea not warranted by the facts. Defence is super-erogatory. The italic is often misused. For the rest, the humour of our friendly controversy is not lessened by the fact that Mr. Schonberg is an American and the editor of this Magazine is an Englishman.—EDITOR.

Waihi Grand Junction.

The Editor:

Sir—In your June issue on p. 464 there is the following statement having reference to the Waihi Grand Junction mine:

“For many years the results of development work were disappointing, and much capital was spent to no purpose. In 1909 F. C. Brown, the manager, resigned, and he was succeeded by W. F. Grace, who has effected a radical change and made the mine profitable.”

These sentences give an incorrect impression concerning Mr. Brown. The time when capital was spent to little or no purpose was prior to his régime. Mr. Brown introduced many improvements and economies in the methods of working the mine and battery, but left Waihi before the full effects of his work were apparent. Thus the very considerable reduction in milling and treatment costs made after Mr. Brown's departure was in great measure due to his management. It is recognized in New Zealand that Mr. Grace has done remarkably good work at the Waihi Grand Junction, but it is to be regretted that while paying Mr. Grace a compliment, which is doubtless well-deserved, you convey a totally misleading impression concerning his predecessor, who, as the chief inventor of the B. and M. or Pachuca vat, merits kindlier treatment. I may add that Mr. Brown is personally unknown to me, and it is only a wish to see justice given that impels me to write this letter.

P. G. M.

Wellington, August 9.

We publish this letter with pleasure.—
EDITOR.]

PRECIS OF TECHNOLOGY

Richards' Tin-Extraction Process.—The daily Press has recently contained references to the new process to be applied in Cornwall by Arthur Richards for the purpose of extracting tin from ore by chemical means. This process is covered by British patents 26644 of 1911 and 56 of 1912. The first patent describes the process as one intended for the recovery of tin from ore, tailing, slag, or other tin-bearing material, by converting the tin into volatile tin compounds. The process is specially intended for application to poor ores, and by its means it is claimed that almost the whole of the tin can be extracted. If the ore is rich, it is desirable to mix it with low-grade ore or with sandy material. The ore or other material is finely ground, and mixed with a small quantity of coal or other reducing agent, together with common salt. The mixture is heated in a furnace to a temperature somewhat higher than cherry red, with the result that the tin is volatilized as fume partly composed of chloride of tin. This is collected and is subsequently treated for the metal in any usual manner. The amount of salt and coal may be as little as 2½% of each; the amount varies with the nature of the ore, but would never in practice be more than 10 to 15% of each. In some cases the ore may contain some constituent which will reduce the amount of coal required. The second patent extends the claim from common salt to any chloride or bromide, and mentions that the addition of potassium bromide to common salt is advantageous.

High Grade, California.—During recent months much has been heard in the American Press of the High Grade gold-mining district, situated in Modoc county, California, immediately adjoining the State of Oregon. By the way, we wish that the discoverers of new ore deposits would refrain from using such general words as Goldfield, Cobalt, and High Grade for the names of their townships. Many exaggerated ideas as to the nature of the ore and the prospects of development have been propagated, and comparisons have been made with Cripple Creek, Colorado, and Goldfield, Nevada. It is therefore of special interest to know that W. H. Storms, the State Mineralogist, has paid an official visit to the district. His views and opinions are contained in an article published in the *Mining and Scientific Press* for August 31. The district is on the summit of the Warner range, which lies between Goose lake on the west and Surprise valley on the east. This range consists of a thick series of volcanic flows and sediments, that form a portion of the great volcanic plateau of Modoc, Shasta, and Lassen counties in California and of the adjoining parts of Oregon and Nevada. The appearances show that a vast mass of nearly horizontal volcanic strata, chiefly andesites, rhyolites, and tuffs were cut by a great fault skirting the east shore of Goose lake. Probably this lake is the direct result of the faulting. In the central part of the range there are several minor faults, and it is in the vicinity of these that the principal mineralization has taken place, along zones of brecciation, or following fissures in the breccia. Where these fissures have intersected each other, there has occasionally been enrichments. After the uplift of the range and the formation of the brecciated zones and fissures, there was a long period of erosion, as is evidenced by the strata of rhyolites and tuffs being planed off in some localities. Moreover, where later flows of basalt and andesite, with their accompanying tuffs, overlie the adjacent hills to the eastward, tongues and remnants of the basalt are found lying on the older rhyolite and tuff; this would be impossible had not

the upper rhyolite been removed by erosion. These later volcanic rocks have no connection with the mineralization of the district. Prospectors will do well to follow the older mineralized volcanic rocks below the capping of the later rocks. The principal rocks are a white flow-rhyolite at the top, underlain by a bed of varying thickness of white rhyolite-tuff usually buff-coloured near the surface; this is in turn underlain by purple porphyritic rhyolite. At the extreme north of the district these rocks pass under the more recent basalt. At the south end the rock is chiefly an earlier andesite. There are several types of ore deposit. The commonest are zones of brecciation, highly silicified and auriferous; these occur in flow-rhyolite and tuff, and also in the earlier andesite. A second type consists of small fissure veins cutting through the veins of brecciation at high angles; at the intersections rich ore has been found. A third type occurs in the form of nearly flat sheets of rhyolite or tuff, highly silicified and auriferous, but with little or no brecciation; these may be considered as zones of impregnation. A fourth type is the fissure vein occurring outside any zone of extensive brecciation. Sulphides, chiefly pyrite, are found in the veins, but the gold does not appear to be much associated with them, occurring chiefly in the secondary silica.

Derdepoort Diamonds.—The *South African Mining Journal* for August 24 revives the discussion as to the nature of the diamondiferous rocks at Derdepoort, situated five miles northeast of Pretoria. This unusual geological occurrence was described some years ago by the Survey as a volcanic breccia, and petrographers and geologists are still puzzled as to its nature. For some time, extensive operations have been conducted by H. F. Cooper on behalf of the Central Diamond company. A large number of shafts and cuttings have been made, and though diamonds have been found, it is not possible as yet to state that diamonds can be won on a commercial scale. The extent of the deposit has been proved over an area a mile square, and trials are to be started with a rotary washing-pan at the southern end where the ground is soft and yellow. According to information obtained during these explorations, F. M. Krause is inclined to consider that the main eruptive mass is composed of weathered and unweathered peridotite. It is not supposed that there is any magmatic segregation into basic and acid portions, and what were supposed to be acid dikes have been shown to consist of little more than superficial crusts of acid rock fragments. The fragments found in the peridotite are evidently derived from the various stratified and eruptive rocks through which the true pipe-matter has forced its way. They consist of felsite, quartzite, shale, diabase, and large blocks of dolomite. All except the last-named are found on the surface in the neighbourhood, but the dolomite has apparently been brought up from a depth of one or two miles. The actual existence in the pipe of boulders of dolomite is of less interest than the fact that an enormous quantity of it has been raised from the lower horizons of the Transvaal system, and in such a manner as to practically saturate the whole pipe with carbonate of lime. The Geological Survey report said: "There are the usual angular fragments of red granite, quartzite, and dark shaly material, with an occasional crystal of biotite. But we notice a good deal of calcareous rock, having the appearance of veining the breccia, and not showing any fragmental characteristics." Such carbonate of lime obviously gained access by hydrolytic action. The all-pervading presence of carbonate of lime has had the effect of disguising the real character of the micaceous pipe

rock to such an extent that it is difficult to say authoritatively what the pipe-rock really is. The presence of biotite, ilmenite, and diamonds suggests that it is a variety of kimberlite. The owners so far have not taken steps to obtain a complete petrographical examination, preferring to depend on ordinary prospecting and sampling.

Genesis of Diamonds.—In the *Journal of Geology* (Chicago) for July–August, Orville O. Derby contributes a second article, following the first published in the same journal last year, on the origin of the diamond. The second article is prompted by the publication in Germany of a monograph by Fersmann and Goldschmidt, where it is shown that diamond crystals have been formed suspended in a molten mother-liquid. Mr. Derby's deduction from this argument is that diamonds were not necessarily formed under the influence of extraordinary pressure and heat, and it is therefore possible to give consideration of the hypothesis that the diamond is a secondary mineral crystallized out of some carbon-bearing solution. Mr. Derby thus summarizes his idea of the geological conditions under which the diamond has been formed:

The diamond occurs in the form of isolated complete crystals closely enclosed in a rock of eruptive origin occurring in dikes and pipes and having the readily alterable minerals olivine and pyroxene as its leading essential constituents.

This rock, wherever diamonds have been found in it, shows evidence of having been fractured after its consolidation to such an extent as to permit a sufficiently free circulation of subterranean solutions to produce a very advanced stage of alteration in all its olivine-bearing portions, so that the only portions that remained perfectly fresh are certain unfractured pyroxene-garnet segregations free from olivine.

The circulating solutions introduced water (locked up in the serpentine and other secondary minerals) and carbon (locked up in the calcite) both of which were lacking in the original rock.

The circulating solutions attacked the garnet of the enclosed pyroxene-garnet segregations wherever these were sufficiently fractured to permit it, producing an alteration crust of secondary minerals. Unfractured segregations would naturally be attacked only on their surfaces adjacent to the more fractured and thus more permeable olivine-bearing portions of the rock, and thus their (presumably) rounded original form would be accentuated through corrosion, giving them the aspect of water-worn pebbles.

After (or concurrently with) the alteration of the garnet, carbon crystallized in the form of diamond adjacent to the secondary crust formed on the mineral, and also, as Beck demonstrated in his study of the diamond-bearing nodule from the Newlands mine, in the form of graphite.

Osmiridium in Tasmania.—In the *Mining and Engineering Review* for August, T. H. Jones describes the placer deposits of osmiridium of Tasmania. These are found in the northwest part of the island, between Mount Bischoff and Corinna. The latter town is on the Pieman river, into which run the White, Heazlewood, and Savage rivers, these and their adjoining creeks containing the valuable gravel. Twenty or more years ago the gravel toward Corinna was extensively washed for gold, and the accompanying osmiridium was considered a nuisance. As the workings followed up the river courses, less gold and more osmiridium was found. The present high price offered, over £7 per ounce, has revived interest in the deposits. The country where the metal is found is at and near the contact of serpentine rock with schist and metamor-

phosed slate. So far, the original matrix of the metal has not been found, and the workings are confined to the bedrock of the river beaches. The metal is caught chiefly in the crevices of the schist, and it is necessary to break this rock for a depth of two feet or so in order to obtain a profitable extraction. At one time an attempt was made to dredge these rivers, but the great size of the boulders and the raging floods have combined to make this method of exploitation impossible. The most elementary means has to be adopted. The surface drift is shovelled away by hand and the schist bedrock is broken by pick. The lower gravel and the broken rock may be washed in a pan or it may be carried in buckets to a sluice-box. The work is far from comfortable, for, owing to the wet nature of the climate, the beaches are more often than not covered with water. The deeper parts of the river beds have not yet been tested.

Steel Sets in West African Mines.—In the *Mining and Scientific Press* for September 7, Walter Lyman Brown describes the steel sets adopted at the Abbotiakoona inclined shaft. As our readers know, the timber found in West Africa is not suitable for mining purposes, and the pine imported from Oregon and Norway has a very short life. We reproduce the illustrations herewith; as these are dimensioned, and are in the form of actual working drawings, they are largely self-explanatory. All the joints are made by means of bolts, so that the parts can be readily put together underground. In criticizing the design of the structure the author points out that in inclined shafts, the pressure from the hanging wall is resisted by forces acting in two planes; one at right angles to the shaft, carrying the weight through the dividers and end-plates to the sill and foot-wall of the shaft, and the other along the line of the shaft, through the studdles or distance-pieces to the bearers. The latter becomes especially prominent when the hanging wall is heavy and loose, and the author considers the cap to be of too high and narrow a section to resist this component of the weight. A girder of the same weight, but with an approximately square section, would resist this force better and would offer little resistance to downward pressure. The tendency of this force acting along the line of the shaft is to bend the caps between the studdles along this line, and to cause a slight creep of the lagging on the caps, causing them to bend on the web. In the Abbotiakoona main shaft, where, in replacing timber sets with steel, a section of ground had a heavy hanging wall, requiring false sets and driving of the lagging, in several instances caps were bent in the web through arcs of at least 30°. This could, to some extent, be improved by using caps of a squarer section and shorter and thicker web.

All sets are put in with a batter up the shaft of approximately 6 in., that is, the cap is some 6 in. farther up the shaft than the sill, measured from a line at right angles to the incline of the shaft. All sets, where there is any weight on them, tend to 'ride' down the shaft, this tendency being resisted by the bearers. Putting in the sets looking up the shaft partly counteracts this ride, as the caps swing through an arc the radius of which is the height of the sets, and the centre of which is the bottom of the sill, the latter in a fixed position. Sets thus placed, therefore, in order to ride, must first force up the weight of the hanging wall supported by them. Sets put in at right angles to the incline are only kept from riding by the bearers, and in practice these are usually not entirely effective; when a set has passed the right angle and is looking down the shaft, even to a slight degree, its value as a support to the hanging wall is greatly lessened.

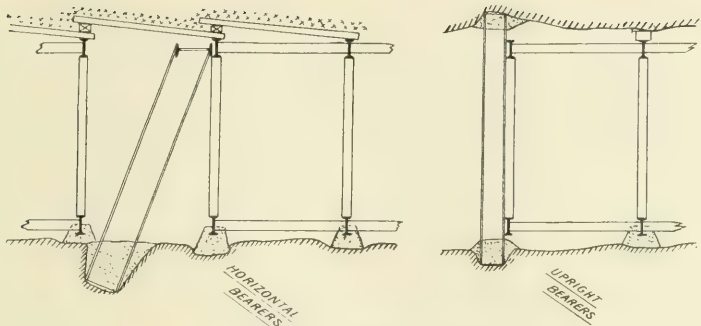


FIG. 1 GENERAL ARRANGEMENT OF FRAMING.

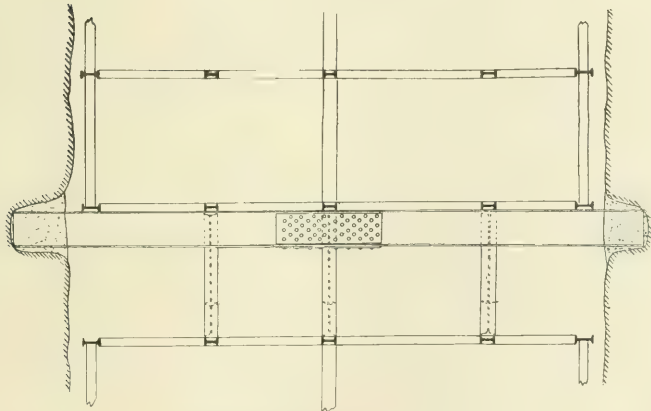


FIG. 2. HORIZONTAL BEARER.

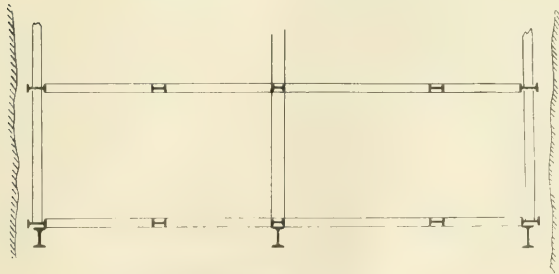


FIG. 3. UPRIGHT BEARER.

Blocking is done in the manner customary with timber sets, namely, at the four corners, both top, sides, and bottom, and above and below each divider. The native timber *kako* is largely used for this purpose. Sills are often placed on small concrete pillars, the sills being imbedded to about half their depth in the concrete. This is done more especially near the surface, where the ground is apt not to be as hard and firm as it is at greater depths. In one instance, sets are carried for some distance on three continuous concrete piers, running up and down the shaft.

Rails are bolted to the sills, through holes drilled in the flanges of each. The sills are drilled to template in the shops and the rails are drilled in position in the shaft with hand ratchets or pneumatic drills. This gives excellent results, insuring rigidity, and entirely prevents any slipping of the rails which so often happens in inclined shafts. Bell and power cables are also bolted by means of clips to the sets.

Bearers are put in at varying intervals, depending on the ground, of 50 to 100 ft.; 60 to 80 ft. is the most common distance. In the heavy ground in the Abbontiakoon shaft, previously referred to, they have been put in as close as 30 ft. apart, but this was an exceptional case. The class of bearer used also depends on the nature of the rock. In ground with a firm or fairly firm hanging wall the ordinary 'upright' bearer, so called in distinction to the horizontal or longitudinal bearer, is used. This is the type commonly used in all shafts, well hitched into both foot and hanging, with the lead into the upper side of the hanging wall hitch, and with the bearer firmly concreted into its place. Usually three bearers are put in to each set, one below each end-plate and one below the centre divider, and they are usually I-beams of about 6 by 10 in. section.

Where the hanging wall is not sufficiently firm to afford a secure hold for upright bearers, horizontal bearers must be used. These, as used in the Abbontiakoon shaft, are 6 by 16-in. steel I-beams (see Fig. 2), spliced in the centre. Splicing is necessary, as, from the nature of the ground, the sets must be kept close to the face, allowing no room for leading the bearers into hitches. A lap-joint is used, with plates on each flange and on both sides of the web of the girder, all being drilled to template in the shops and put together in the shaft with bolts. Hitches are cut deep with bearers of this class, as the ground is apt to be weak, and they are firmly concreted into position. In addition, braces of 6 by 16-in. I-beams are put in as shown in Fig. 2, these being cut at the top to the shape of the bearer and firmly hitched and concreted into the foot-wall. In spite of the strong girders used, both as bearers and braces, in one shaft with heavy hanging wall, it is not uncommon to see the bearers bent several inches down the shaft by the riding due to the vertical component of the weight. Horizontal bearers are not allowed to take any down-weight, as they are set the wrong way and are not supported to withstand it. All bearers are so placed as to give the sets the batter up the shaft previously mentioned. Corrugated steel sheets have been used with good results as top lagging, where driving is not required. They are held in position by S-shaped clips hooked over the caps. They are not satisfactory for side lagging.

Preventing Blasting-Fumes.—In the *Queensland Government Mining Journal* for August 15, W. H. Mawdsley, of the Mount Morgan mine, describes a tamping invented for the purpose of checking the formation of various fumes during blasting, more particularly in pyritic deposits. This tamping consists of an alkali hydrate, such as that of lime or barium, mixed

with a little water. This will rapidly absorb carbonic acid given off by the explosive, with the formation of a carbonate which mingles with the dust. The tamping will also prevent the ignition of the pyrite, and readily absorb any sulphurous fumes evolved. The author states that an oxidizing agent can be added for the purpose of converting carbonic oxide into carbonic acid.

Nickel Coinage.—The *Mining and Engineering World* (Chicago) for September 7 contains an article by L. K. Hirschberg describing the proposed new nickel coins for the United States. The copper or bronze cent is to be abolished in favour of one made of nickel, and 3-cent nickel pieces are to be introduced. The greatest innovation from the economic point of view, however, is the coining of a $\frac{1}{2}$ -cent nickel piece. The metal employed for the new coins is to be of practically the same quality as that used at present for the 5-cent piece. To distinguish between the 5 and 3-cent pieces, the latter is to have a central hole, in the style of Chinese coins. Many numismatists have urged that there will be confusion between the cent, the $\frac{1}{2}$ -cent, and the silver 10-cent. The introduction of 3 and $\frac{1}{2}$ -cent pieces is considered a step in the right direction from the point of view of the people generally, for many commodities are now sold at 1 cent and 5 cents solely because of the absence of any respective smaller coin.

The Future Output of Gold.—The *New York Sun* for September 8 publishes an interview with H. C. Hoover. He reviews the conditions and prospects in each country, and arrives at the conclusion that the rate of increase of output has been checked and that the production has reached its maximum.

The placer gold of Europe was practically exhausted in Roman times. Lode mining is a small industry and every foot of ground is known. In Asia the Chinaman has washed the gravels from Siam to Tibet and Mongolia years ago. In lode mining he has long since exhausted the mines down to water level, and if mines do exist it will be a slow business finding them. It is hard to imagine that there is in China or Central Asia a district of such importance as to materially affect the question, for there is no greater illusion than that the Chinaman has any prejudice against mining for gold when he can make a profit. And he can make lode mines profitable by hand labour on which we could not earn a cent with the finest machinery ever built.

In India mining has been going on for thousands of years. The placer deposits are exhausted, and in the only lode-mining district of importance the mines are now 3500 ft. deep and are becoming increasingly difficult to operate.

In Asia Minor the alluvial gold has been exhausted since Cræsus' time. There may be some lode mining, but it is a striking fact that none of the districts that were worked by the ancients—and they worked everything they could find—give any evidence of large extent.

In Egypt hundreds of ancient workings have been opened up during the last few years, to the grief of the operator. In fact all the mines in these old civilizations, Egypt, China, Central Asia, and India, were worked by slaves or convicts who were fed with impressed food, so that all of the metal was profit; and thus hundreds of deposits were worked which prove of no use to the modern operator with all his appliances. And it is scarcely probable that the ancients deliberately chose the worst deposits.

In Australasia, the placer industry is in its dotage. The lode districts within the distance of say 300 miles from the coast line are in their decadence. The great interior desert is partly unknown, but has in recent

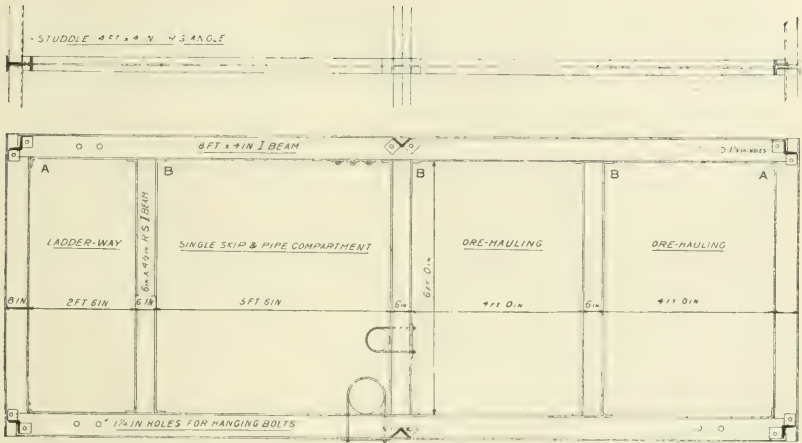


FIG. 4. GENERAL PLAN OF FRAMING.

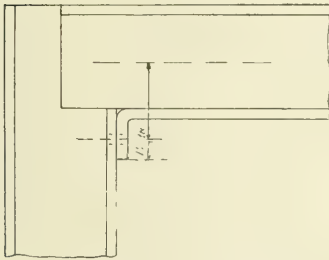


Fig. 5. DETAIL AT A

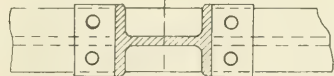
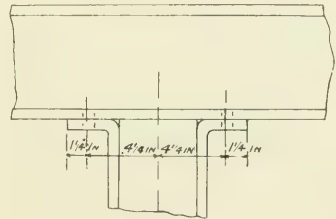


Fig. 6. DETAIL AT B

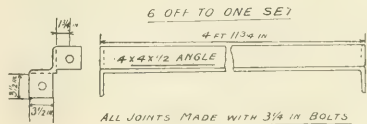


Fig. 7. DETAIL OF STUDDLE

years been much traversed. The districts in the interior so far discovered, such as Coolgardie, Kalgoorlie, etc., are all nearing their end. The maximum output from Australasia was reached about five or six years ago, and it has been steadily decreasing ever since.

Placer mining in the United States made a recovery from apparent extinction a few years ago by the rise of the dredging industry; this has passed its zenith and the output will soon begin to decrease if it has not already done so. Lode mining has had no accessions since the Nevada discoveries of ten years ago. Altogether the outlook is decidedly toward diminution of the output.

Canada poured a vast quantity of gold out of the Klondyke hand-worked placers, but that stream has become but a trickle from the giant dredges now being

built to handle the leavings of the early pioneers. Elsewhere, even with Porcupine thrown in, that country cannot, from anything in sight, maintain its average of ten years ago, although the unknown territories are more pregnant of new mines than the now well prospected countries further south.

Siberia has been vaunted as the future gold source of the world, and gold is wonderfully distributed over that country. But so are dismantled mills and abandoned dredges, a confirmation of the opinion of all engineers of experience in that region that but little of the area promises profitable mining. Some hope does, however, exist for successful new dredging areas in the extreme northeast.

South and Central American placer gold was practically all seized by the Spaniards. The lode mining has had English capital poured into it for generations. One company is nearly a century old, and on balance only a loss has resulted.

On the Rand, which produces over one-third of the world's gold, the mines are already becoming fairly deep, the ores are becoming poorer with depth, the profit to be won from the shallower areas was vastly over-estimated, labour and physical conditions are steadily becoming more difficult, working costs are rising and the grade of ore falling. This district will certainly not materially increase its output, and it would not be surprising to see an appreciable decrease within 12 months. It will go on producing gold for fifty years, but in steadily diminishing quantity, and even 10 years will see a great decrease.

Outside of the Transvaal, there are two large areas known in Africa, that is Rhodesia and West Africa. The gold deposits of Rhodesia are mostly of the erratic quartz type, and in the aggregate cannot be expected to return the money invested.

West Africa has been vastly over-estimated, and the tombstones of English companies that have been operating there are now being set up by the score. There are some unexplored places on that continent, but they are much less than is currently believed by those unfamiliar with the great amount of prospecting that has been in progress during the last 15 years. Large areas of the Congo Free State, Uganda, Nyasaland, Nigeria, Sudan, Sahara, etc., have been demonstrated to be geologically unfavourable, and the probability of any gold industry is of the remotest kind in these territories.

It is not that no new mines will be discovered, but that great districts are unlikely and that the annual supply of new isolated mines will not replace the frail and dying members. Advantage of the great opportunities for the application of new methods has already been taken; no industry has had such a generous supply of capital for every warrantable enterprise. Further the opportunities for improvement on modern methods, and thus the increased chance for low-grade or refractory ores, are no longer of importance. The increase in percentage recovery from 60% to over 90% offered many opportunities and realized much increase in production, but the region for expansion between 92% and ultimately 95% is small. The cost of working has been reduced to near bedrock by mechanical equipment, until the room for further improvement amounts to cents per ton and not dollars as it was formerly. And in this last connection the cost of wages and supplies in this industry is increasing, as in all others, and will more than offset any reduction due to improved methods. The working costs on the Rand, in Australia, in Russia, and elsewhere show a considerable rise during the last two years. This in itself will tend to diminish the output.

Metallurgy of Aluminium.—The *Engineering and Mining Journal* for September 21 reprints a paper read by Alfred H. Cowles before the International Congress of Applied Chemistry, describing the new process for extracting aluminium from ordinary clay devised by himself and the late Adolf Kayser. Mr. Cowles and his brother were pioneers in the metallurgy of aluminium, but the early rewards went to Hall and Heroult. According to the new process, clay is mixed with common salt and carbon, and moulded into porous briquettes. These are exposed to the action of heat and steam. The result is the production of sodium silico-aluminate and hydrochloric acid. The former is subsequently ground and heated with lime, the reaction giving silicate of lime and sodium aluminate. The latter is removed by leaching, and decomposed into caustic soda and alumina in the usual way by bringing it into contact with a small amount of aluminium hydroxide.

The same issue of the *Engineering and Mining Journal* briefly describes the Serpek process. This consists of treating purified bauxite in the electric furnace with air and coke, thus forming aluminium nitride. This is then treated with caustic soda, and sodium aluminate and ammonium sulphate are formed.

CURRENT LITERATURE.

Measuring Stopes.—In the July issue of the *Journal* of the Chemical, Metallurgical, and Mining Society of South Africa, O. Tonnesen describes his 'Simplex' stope-measuring instrument.

Winding Engines.—The *Iron & Coal Trades Review* for September 20 reprints a paper read before the South Wales Institute of Engineers by A. E. du Pasquier, giving a comparison of the various systems of electric winding engines, with special reference to the influence of the shape of the drum in longitudinal section.

Mine Sampling.—The *Engineering and Mining Journal* for August 31 reprints a paper by E. F. Pelton describing the method of close sampling adopted at the Detroit Copper Co.'s mine in Arizona.

Mine Samples.—The *Monthly Journal* of the Chamber of Mines of Western Australia contains an article by W. B. Blyth discussing the reliability of various methods of preparing mine samples for the assayer.

Caving System of Mining.—In the *Engineering and Mining Journal* for September 7, L. D. Davenport commences a series of articles on the method of development of the iron ore deposits in the Chisholm district of Minnesota, by a specially devised caving system.

Metallurgy at Lucky Tiger.—The August *Bulletin* of the American Institute of Mining Engineers contains a paper by D. L. H. Forbes, describing the modern cyanide plant erected to treat the poorer portions of the complex silver ore at the Lucky Tiger mine, Sonora, Mexico.

Standard Copper. In *Metallurgical and Chemical Engineering* for September, Ernest A. Lewis, of Birmingham, criticizes at considerable length the standard specification for copper, proposed by the American Society for Testing Materials.

Mason Valley Copper Smelter.—In the *Mining and Scientific Press* for August 31, T. T. Read describes the new copper smelter in Mason valley, Nevada. This plant has been designed with an eye on the possible 'smoke-farmer.' The performance of the blast-furnace is notable, owing to the large amount treated per day of a charge containing as much as 10% coke.

Ashio, Japan.—In the *Mining and Scientific Press* for August 24, H. Foster Bain gives additional information about the Ashio copper mine and plant, Japan, supplementing that published in an article appearing in the issue of October 14 last.

Electric Precipitation of Dust.—In the *Journal* of the Franklin Institute for September, W. W. Strong discusses the scientific principles underlying the methods of precipitating dust and fume from gases by means of electric discharges.

Determination of Sulphur in Pyrite.—In the *Engineering and Mining Journal* for August 31, A. M. Smoot describes an electrolytic method of estimating the sulphur content in pyrite.

Persistence of Ore in Depth.—The *Mining and Scientific Press* for August 24 and 31 contains an article by T. A. Rickard, summarizing our knowledge relating to the persistence or otherwise of ore in depth.

Gold in Colombia.—In the August *Bulletin* of the American Institute of Mining Engineers, F. P. Gamba describes gold-mining operations at the southern end of Colombia.

Mount Lyell. In the *Australian Mining Standard* for August 1 and 8, Hartwell Conder reviews the geological possibilities at the Mount Lyell group of mines, in the light of the most recent information.

Soluble Phosphates.—The *Engineering and Mining Journal* for August 31 describes the Newbery calcination process for rendering natural phosphates soluble, and thus suitable for use as fertilizers.

Sulphur in Texas.—In the *Engineering and Mining Journal* for September 7, Richard H. Vail describes the new venture at Bryan Heights, near the coast in Texas, whereby a deposit of native sulphur in dolomite is to be exploited by the Frasch process.

Nova Scotia.—The *Canadian Mining Journal* for September 15 is devoted entirely to the mineral deposits and mining operations of Nova Scotia. Iron, steel, and coal form the foundation of the mineral industry of this province, for the production of gold is trifling and no copper or other base metal is mined. The issue describes the work done by the Dominion Coal Co., the Dominion Steel Corporation, and many other similar businesses. The gold-mining chapter is written by H. B. Pickings, Assistant Inspector of Mines. He quotes 'The Domes of Nova Scotia,' but gives the author's name as 'T. A. Richard.' In one of the articles we find an interesting account of the Bettington boiler, which is beginning to find its way into the Dominion.

Copies of the original papers and articles mentioned under 'Précis of Technology' and 'Current Literature' can be obtained on application to The Mining Magazine.

BOOKS REVIEWED

STRUCTURAL AND FIELD GEOLOGY. By James Geikie. Cloth, octavo, 450 pages, with many illustrations. Edinburgh: Oliver & Boyd. Price 12s. For sale by *The Mining Magazine*.

This book, of attractive appearance, is by the Murchison Professor of Geology in the University of Edinburgh. He is a younger brother of Sir Archibald Geikie and belongs to a family that has contributed famously to British geology. The book is intended for students, both young and old. It is adapted to the use of the professional men to whom some knowledge of structural geology is important. To civil engineers, architects, and the like, such a book will prove highly illuminating. To mining engineers it will not be without interest, especially if they have had only a

scanty teaching in geology. For colliery engineers' it is particularly fitted as a means of elementary instruction, but to miners of the precious metals, and the more valuable of the base metals, it will scarcely appeal. The author is not sufficiently in touch with metal mining. We turn to the two chapters on 'Ore-Formation' and find them unsatisfactory. They are elementary and academic. To those quite ignorant of the subject, Professor Geikie's treatment of it may be useful, at the risk occasionally of proving misleading. British geology is characteristically weak in its application to ore deposits. Mr. Geikie is no exception. He assumes that vein-fissures "tend to die out upwards," that "the present surface at which lodes crop out must be far below that which existed at the time of their formation," and that secondary enrichment "sometimes extends to a depth of 600 feet or even 750 feet from the surface." At Butte, for example, secondary enrichment extends to 2500 feet. Erosion is at least as painfully slow as the deposition of ore is patiently deliberate; in any case, an expositor of the subject should know how to distinguish between a lode and those enriched parts of it that constitute ore. Again, it is not obvious why fissures should "die out upwards"; it is more likely that they will open upward, whither the pressure decreases, and close downward, whither such pressure increases. The author does not give references to his bibliography and he uses interpretative drawings without acknowledging the originator: for example, that of the Bendigo saddle-reefs, which the critic recognizes. The repeated use of that essentially British provincialism 'meet with' is irritating; it is found two or three times on a single page. In science and technology, when employed as a verb to introduce a salient observation, this preposition-verb is particularly tiresome. Outcrops are "met with," lodes are "met with," and ores are "met with." For instance, "lodes are met with traversing rocks of all ages." This might be changed to: "lodes are known to traverse rocks of every geological age."

The book is admirably printed and beautifully illustrated, largely from drawings by the author's son, Mr. W. Cranston Geikie. T. A. R.

TIN DEPOSITS OF THE WORLD. Third Edition. By Sydney Fawns. Cloth, octavo, 320 pages, illustrated. London: *The Mining Journal*. Price 15s. For sale by *The Mining Magazine*.

It is with books as with men: "Some have greatness thrust upon 'em." When a branch of mining, not hitherto widely studied, happens to be attracting the attention of promoters, the engineers deputed to make examinations are glad to consult any sort of description of book that deals in detail with the subject. In default of anything better on the tin deposits of the world and the method of working them, Mr. Fawns' book has had, for this reason, a large sale. The book consists largely of reprints of articles and quotations from other publications written by men of eminence, and by making this collection of scattered literature Mr. Fawns has undeniably done a service; but it is often difficult to determine where the quotation ends and where Mr. Fawns' own paragraphs begin. And, seeing that so much of the book is reprinted from other sources, it seems odd that the word 'copyright' should be stamped in blue letters on the title page. Though he has collected a large amount of authoritative information, he presents it without much system, and often inconsequentially. A great number of errors are to be found. For instance, he refers to 'Dalcoath' in the preface, presumably meaning the mine in Corn-

wall and not the less known property in Tasmania. The Dolcoath vertical section is not up to date, for the new vertical shaft is shown to be only 70 fm. below adit. In the bibliography, Pospenny appears as 'Prosepey,' and no reference is made to J. H. Collins' 'Observations' published in February last. The map to illustrate the chief mining centres in Cornwall omits the St. Just and St. Agnes districts. Like other people, Mr. Fawns finds the 'Précis of Technology' appearing in this magazine useful. Seeing that many of our abstracts contain explanatory or critical matter not to be found in the original articles, we think an acknowledgment of the source of the précis would be only fair. In spite of the faulty construction of the book, it will, for the reason mentioned at the beginning of the review, continue to have a large sale. E. W.

SOUTH AFRICAN GEOLOGY. By E. H. L. Schwartz. Cloth octavo, 200 pages, illustrated. London: Blackie & Son. Price 5s. For sale by *The Mining Magazine*.

The author of this book is professor of geology in the Rhodes University College, Grahamstown. He is fully aware of the difficulties of a teacher whose views differ from those of the possible external examiner; he would probably be better advised for this reason to keep to orthodox lines when addressing young students, while continuing to elaborate his own views and theories in articles for the geological periodicals or for a special treatise. As with Mr. Gregory, whose book we also review in this issue, Mr. Schwartz has adopted the planetesimal theory of the formation of the earth, and no small part of the book is occupied in elaborating this theory from geologic facts as found in South Africa. Another feature of the work is that it has been written from the point of view of the student who knows no other country but South Africa. It is not intended as a substitute or rival to Rogers' and Hatch & Corstorphine's works. Knowing its limits and objects, we can welcome it to our shelves.

PRACTICAL FIELD GEOLOGY. By J. H. Farrell and A. J. Moses. Flexible leather, 280 pages, illustrated. New York: McGraw-Hill Book Co. Price 10s. 6d. For sale by *The Mining Magazine*.

Many books are nowadays published with the object of instructing prospectors in the principles of applied geology. Mr. Farrell's efforts are of quite an elementary nature and his instructions and advice are occasionally professedly quaint and humorous. His list of requirements for those engaged in field work includes two flannel "skirts," four handkerchiefs, one toothbrush, safety razor (?), one pair of suspenders, and so on. The section of the book for which Mr. Moses is responsible consists of a "guide to the right recognition of 120 common or important minerals." These minerals are classified in several ways and the paragraphs descriptive of each are repeated under each classification, an arrangement which causes much unnecessary repetition.

DANA'S MANUAL OF MINERALOGY. By William E. Ford. Small octavo, 460 pages, illustrated. New York: John Wiley & Sons; London: Chapman & Hall. Price 8s. 6d. For sale by *The Mining Magazine*.

We have several times referred to the issue of new editions of well known books, the authors of which have passed away, and we have expressed the opinion that such revisions are inadvisable. It comes a surprise to find that a new edition of Dana's 'Manual' has been placed on the market, the more so as it is frankly stated that the new edition is not a revision, but practically a new book. No doubt many American en-

gineers will buy it for the sake of old associations. The 'Manual' was first published in 1848, and was revised several times, the last edition being that of 1887. For the purpose of keeping the series of the Dana mineralogies complete, Mr. Ford was commissioned by Edward S. Dana to prepare this new edition of the 'Manual.' As recorded above the result is rather a new book than a new edition, both the text and the illustrations being unrecognizable by old students. The section on petrography has been dropped. So many good books on mineralogy have been issued in recent years that it would seem to be unnecessary to perpetuate the 'Manual.' We do not wish to belittle Edward S. Dana's work in other directions, for we consider his continuation of the 'System' to be of the greatest value both to the scientist and to the mining engineer. The continuance of the 'System' is of far more importance than the revision of the 'Manual.'

THE COAL RESOURCES OF NEW SOUTH WALES. By Edward F. Pittman. Paper boards, 102 pages, with maps and illustrations. Sydney: The Government Printer. Price 1s. For sale by *The Mining Magazine*.

On several occasions recently we have referred to the useful publications issued by the Geological Survey of New South Wales. The book just to hand describes in detail the coal deposits from the geological and commercial point of view. It is virtually a second edition of the chapter on coal published in the 'Mineral Resources' for 1901. Many metallurgical operations have been attracted to these coalfields, in connection with mines in distant parts of Australia, and the latest, the smelting of the iron ore deposits owned by the Broken Hill Proprietary, is by no means the least important. In fact it is this new venture that adds special interest to the book.

GEOLOGICAL SURVEY OF SOUTHERN RHODESIA. By H. B. Maufe. Paper, foolscap, 56 pages, illustrated. Salisbury and Bulawayo: The Argus Printing & Publishing Co. Price 2s. For sale by *The Mining Magazine*.

Why is this publication sent to England to be printed, and subsequently distributed solely from Rhodesia? The contents are of considerable interest, notably Mr. Maufe's introductory chapter on the geology of the country round Selukwe, and his description of the Victoria tin district. There are several other contributions, written by A. E. V. Zealley and B. Lightfoot.

THE MAKING OF THE EARTH. By J. W. Gregory. Pocket size, 260 pages. London: Williams & Norgate. Cloth 1s.; leather 2s. 6d. For sale by *The Mining Magazine*.

This little book forms one of the volumes of the 'Home University Library,' and it has been written by the professor of geology in the Glasgow University. At the present time, it is the fashion among publishing houses to issue series of small cheap books. Most of these are merely reprints, but on the other hand several publishers are providing entirely new books, all written by eminent men, and calculated to please the earnest searcher after knowledge. The series issued by Williams & Norgate is to be highly commended. This firm has an unrivalled reputation among serious students, and their shop has always been the resort of philosophers. They are the publishers of the works of Herbert Spencer. Mr. Gregory's book affords the reader much food for thought. He discusses the theories of the formation of the earth in a clear and unprejudiced way, and eventually dismisses the nebular hypothesis in favour of the view that the earth consists of an aggregation of cold meteorites. He

shows that the heat of the earth was caused by the concussion and consolidation of these constituents and that it is still generated by contraction. Thus the great bulk of the earth is still solid and consists chiefly of iron, nickel, and other elements associated with known meteorites. The heat has been sufficient to liquefy the non-metallic and some of the metallic portions, and so to form first a primordial crust of basaltic rock, and subsequently a layer of granitic material. We need not follow Mr. Gregory through the whole of his statement of the case; we prefer to recommend our readers to study it for themselves. He describes the introduction of the action of water and gases in connection with the formation of igneous rocks, and the action of water and wind in the formation of secondary rocks. He discusses also the origin of organic compounds and subsequently life on the world, and reviews the arguments that mineral life should receive as much consideration as animal and vegetable life. Within so small a compass and in covering so wide a range of subjects, it is unavoidable that some of the subjects should be dismissed with few words. Naturally we should like to have seen the origin of ore deposits discussed at greater length; but probably, for the chief purpose of the book, the short description of various methods of natural concentration is sufficient. E. W.

ELECTRICITY.—By Gisbert Kapp. Pocket size. 260 pages, illustrated. London: Williams & Norgate. Cloth 1s., leather 2s. 6d. For sale by *The Mining Magazine*.

This book belongs to the same series as the 'Making of the World' referred to in the above paragraph. It is written by the professor of electrical engineering in the Birmingham University.

THE HYDROMETALLURGY OF COPPER. By W. E. Greenawalt. Cloth, octavo, 505 pages, illustrated. New York: McGraw-Hill Book Co. Price 21s. For sale by *The Mining Magazine*.

The wet methods of copper extraction have limited applications, and do not receive much attention from the authors of works on metallurgy. For some years Eissler's book did duty as the standard publication on the subject, though it lacked evidence of familiarity on the part of the writer. Mr. Greenawalt's book is welcome, for it gives much information on a branch of metallurgy the literature of which is widely scattered. Not only is the author a student, as is evidenced by his careful collection of published information, but he has for years conducted investigations as to the lixiviation of copper ores, more particularly in connection with electrolytic methods. Investigators will find the book useful for reference to out-of-the-way metallurgical processes that either have special applications or have been commercial failures.

The book has its limits, for the author devotes the greater part of his attention to his own particular branch. Some years ago Dr. Peters apologized for the omission from his own book of a section on hydrometallurgy, saying that he had not found a collaborator who was not disqualified as an author by being identified with some proposed new process. Mr. Greenawalt is well known as an advocate of processes, and these receive a large share of attention in the book. It is as well to know the author's inclinations.

Though the book covers much ground in connection with collateral subjects as well as with the hydrometallurgy of copper pure and simple, we find no mention of several processes that ought to be included. For instance, we had hoped to find some account of the recent doings of the Malm chlorine process of ex-

traction, especially as this process was being tried in Mr. Greenawalt's own State, Colorado. Seeing that the author includes the Swinburne-Ashcroft process, the Malm method should be mentioned also. The author also omits any notice of the Mond process, though other methods of producing copper sulphate from mattes are described. His mistakes in names are unexplicable; it is disconcerting to read of the 'Oxford' Copper Co., and of the 'Claudit' iodide process.

HIGH EXPLOSIVES. By W. R. Quinan. Cloth, octavo, 210 pages. Melbourne: Critchley Parker. Price 21s. For sale by *The Mining Magazine*.

This long-expected book will be welcomed by everybody who uses dynamite and other high explosives, whether for mining or for other engineering purposes, for it gives much practical discussion about the physics of explosions. Many people will wonder how it is that an American expert, who did his best and most recent work in South Africa, came to give his manuscript to an Australian publisher. Mr. Quinan was born in Maryland and, after serving in the United States artillery, went to California as manager of an explosives factory. In 1899 he was recommended to Cecil Rhodes, and went to South Africa to build a dynamite factory for the Cape Explosive Works, Limited. In 1910 he went to Australia on business for his firm, and while there he wrote a number of articles for the *Australian Mining Standard*. He was seized with mortal illness while in that country, and had no opportunity before his death to revise and complete his writings. The price charged for the book, 21s., is far too high. We do not make this remark in disparagement of the value of the contents, but because the cost of type-setting and printing a comparatively small book does not warrant any such price, especially seeing that the publisher is paying the author or his successors no royalty or share in the profit. Besides, the typography is of poor quality.

GOLD MINE ACCOUNTS AND COSTING. By G. W. Tait. Cloth octavo, 85 pages. London: Sir Isaac Pitman & Sons. Price 5s. For sale by *The Mining Magazine*.

This book is essentially a practical treatise on the method of accounting in use at the great mines of the Rand, where the author has had many years experience; but as, with some adaptation, the system could be followed at mines in other countries, mine managers generally, who find it desirable or necessary to have some knowledge of accountancy, may get many useful hints from a perusal of its pages. The chapters on white and native time-keeping are particularly informing. The value of the book would have been materially increased if sample rulings had been given of the various books and analysis sheets described in the text. H. E. F.

THE MINERAL INDUSTRY: ITS STATISTICS, TECHNOLOGY, AND TRADE, DURING 1911. Edited by Charles Of. Cloth octavo, 1000 pages, illustrated. New York: McGraw-Hill Book Co. Price 42s. For sale by *The Mining Magazine*.

As usual, this year-book of mining and metallurgy contains a vast amount of statistics of production of the metals and minerals, with details of their geographical distribution, together with reviews by specialists of the literature relating to advances in technology and practice. The list of contributors continues to contain the names of many eminent men, such as J. W. Richards, R. H. Richards, L. S. Austin, and H. O. Hofman, but taken as a whole, the volume is distinctly disappointing.

COMPANY REPORTS

Lisburne Development.—This company was formed in 1907 for the purpose of developing the Glogfawr group of lead mines at Pontrhydygroes, Cardiganshire, Wales. R. R. Nancarrow is manager. The report for the year ended June 30 shows that 11,520 tons of ore was raised, and after the removal of 1983 tons of waste, 9537 tons was sent to the mill, where 594 tons of concentrate was produced. This sold for £6863, and the working profit was £1275; after the payment of debenture interest and allowing for depreciation, the net profit was £774. Mr. Nancarrow reports that the developments at the Penlanfach mine are encouraging and that the galena disclosed assays over 28 oz. silver per ton. Owing to the drought a year ago, the dressing plant was not running full time. Additional Frue vanners have recently been erected.

Phoenix Mines.—This company was formed in London in 1909 for the purpose of acquiring the mines of that name, situated seven miles north of Liskeard, Cornwall. It was promoted by the Cosmopolitan Proprietary, a company previously identified with Australian ventures. The report for the year ended June 30 last shows that the task of reopening the mines was greater than contemplated, and that it has been necessary to raise further capital. An additional £50,000 is to be raised, and the issue has been guaranteed by people who stipulate that Bewick, Moring & Co. shall be the managers.

Botallack.—This ancient tin mine near Land's End, Cornwall, has given much trouble to the people associated with it at various times and in different capacities during the last six years. Our pages have recorded the recent history of the property. In March 1911, the finances were reorganized once more. The report for the period from the reconstruction to June 30 last shows that of the nominal capital of £100,000, 95,984 shares of £1 each have been issued. In addition, debentures to the amount of £23,250 have been subscribed. During the time, 28,431 tons of ore was sent to the stamps, 10,199 tons coming from the mine, and 18,232 tons from the dumps. The yield of concentrate was 142 tons, or about 11 lb. black tin per ton. The income from its sale was £16,557, or £116 per ton. It has been decided to proceed with the erection of the additional 20 stamps that have been on the spot for some time, thus bringing the equipment to 40 stamps. The current mining cost was £14,765, and in addition £23,004 has been spent out of capital account on development. Pettit & Poore, the consulting engineers, and Merricks, Crane & Co., the managers, present reports on developments. They do not give figures for ore reserves, but the erection of the other stamps is sufficient evidence of their views.

Geevor Tin Mines.—This company was formed in July 1906, as the North Levant and Geevor, to reopen mines at Pendeen, Cornwall, near Botallack. Oliver Wethered is chairman, and R. Gilman Brown is technical director. The report covering the period from registration to June 30 last shows that 14,455 tons of ore yielded 147½ tons of black tin, an extraction of 23 lb. per ton, realizing £16,823. The expenses were £19,345, and £2966 was written off for depreciation, etc. Development has given excellent results; 60,000 tons of ore has been proved above the 5th level,



Lead, Zinc, and Gold Mines in Wales.

averaging 30 to 35 lb. of extractable tin oxide, and on this level 1300 ft. of the ore-shoot has been exposed. The mill has been extended to a capacity of 100 tons per day, and additional dressing-plant provided that will increase the extraction by 5 or 6 lb. per ton. Further capital is to be raised by the issue of debentures. The plan of the workings adds materially to the interest of the report. It is seldom, if ever, that a Cornish company gives such a plan, or so definite an estimate of ore reserve.

China Clay Corporation.—This company was formed by L. Ehrlich & Co. in the early part of 1910 for the purpose of developing a china-clay deposit at Redlake, on the southern edge of Dartmoor, Devonshire. E. T. McCarthy is on the board, R. Hansford

Worth is consulting engineer, and John Mutton is manager. The report for the year ended June 30 shows that the constructional work required for the proper exploitation of the deposit and preparation of the clay for market is nearing completion. The light railway connecting with the Great Western railway is finished, as also are the steel pipes from the workings to the treatment plant and the earthenware pipes for delivering the finished product in a liquid form to the drying plant. The company is still awaiting the delivery of the engines and pumps. During the year 5s. per share has been called up on the 120,000 preference shares; 2s. 6d. per share remains uncalled.

Barramia Mining & Exploration.—This company owns a gold mine in Egypt between Edfu on the Nile and the Red Sea. It was formed in 1909 by John Taylor & Sons, as a subsidiary of the Egypt & Sudan

and 370-ft. levels the whole block is still intact. He mentions discoveries at several other points. Scarcity of water-supply still gives trouble and new wells are to be sunk.

Mount Bischoff Tin.—The half-yearly report of the premier tin mine of Tasmania, covering the period ended June 30, shows that 600 tons of black tin was obtained, being a recovery of 10.28 lb. per ton, as compared with 550 tons and 10.20 lb. during the previous half-year. The working cost was 4s. 7½d. per ton as compared with 4s. 4d. At the smelting plant, 602 tons of black tin was treated, yielding 403 tons of metal; the plant also treated 1027 tons of custom ore, yielding 726 tons of metal. The profit for the half-year was £42,836, out of which £36,000 was distributed as dividend. Development is actively proceeding on the new ground on the northern slope of the hill, and an



NORTHERN AFRICA.

Mining Syndicate. The capital is £55,000, divided into 216,000 preference shares of 2s. 6d. each entitled to a non-cumulative 10% dividend, and 112,000 ordinary shares of 5s. each. The preference shares also take one-half of the further profits in any one year. The mine was worked by the ancients, and it is characterized by veins that are narrow and occasionally of high content. The report for the year ended June 30 last shows that 4058 tons of ore was raised and treated, yielding gold worth £21,257. The working cost was £14,549, royalty £426, and allowance for depreciation and taxes £1754. The sum of £3559, being 14% less income tax, has been distributed among the preference shareholders, and £1054 among the ordinary shareholders, being at the rate of 4% less income tax. During the year £2896 has been spent on capital account for plant and buildings. Arthur J. Rickard, the retiring superintendent, reports that developments have disclosed ore equal in amount and content to that extracted. Owing to the nature of the deposit he is unable to make any exact estimate; but as an indication of the extent of the reserve he states that between the 130-ft. and 250-ft. levels on Taylor's reef very little ore has as yet been stoped, while between the 250-ft.

aerial ropeway is being constructed. Additional stamps are being erected and some of the old stamps are being replaced by new ones of a heavier type. The dry season has caused a decrease in the amount of custom ore available. The total distribution of dividends since the inception of the company has been £2,329,500, or £191 per £5 share.

New Modderfontein.—This mine is situated in the Far East Rand, and belongs to the Rand Mines group. B. Madew is consulting engineer, and E. Miles Sharp is manager. Operations were commenced in 1896 with 40 stamps, and in 1909 the metallurgical plant was increased to 180 stamps and 5 tube-mills. Since that date 2 more tube-mills and a Butters filter have been added. The report for the year ended June 30 shows an improvement all round; the total profit and the yield per ton have been substantially advanced, and the ore reserve has been increased both as regards amount and content. During the year, 657,806 tons was raised and, after the rejection of 11% waste, 585,900 tons went to the mill. The extraction by amalgamation was 184,081 oz. and by cyanide 56,901 oz., making a total yield of 240,982 oz. The assay-value of the mill-feed was 35s. 5d., and of the final residue

9d.; the yield was therefore 34s. 8d. per ton or 97½% of the estimated content. The income from the sale of gold was £1,011,020, and the expenditure was £546,960, leaving a profit of £464,059 or 15s. 10d. per ton. The amount of ore treated was 47,500 tons greater than during the previous year, and the yield per ton was 5s. 1d. greater. On the other hand, a scarcity of native labour during the last few months of the financial year caused the average cost per ton to increase from 17s. 4d. to 18s. 8d. By concentrating operations over a more limited area, it has been possible since the close of the year to obtain better results with the limited labour force at disposal. The reserve on June 30 stood at 3,900,000 tons averaging 8 1 dwt. gold, as compared with 3,341,830 tons averaging 7 6 dwt. the year before. The revenue account for the year under review shows that £17,781 was spent on capital account on undermining rights, and £41,469 on new plant and shaft-sinking, while £43,152 was paid as government tax. The dividends absorbed £350,000, being at the rate of 25%. Since the formation of the company the yield of gold has been worth £4,915,642, and the dividends have totalled £1,247,500.

Thistle-Etna.—This company was formed in 1908 for the purpose of acquiring the Etna, Thistle, and other gold-mining properties in the Hartley district of Rhodesia. It was promoted by the Rhodesia Exploration & Development company, but the control passed early this year to the Consolidated Gold Fields. The metallurgical equipment consists of Chilean mills and cyanide plant. The report for 1911 shows that 23,354 tons of ore was raised from the Etna mine, and 6315 tons from the Thistle mine. Other ore was taken from the dumps, etc., and the total amount sent to the mill was 33,998 tons. The yield by amalgamation and cyanide was 11,018 oz., worth £47,233, or 27s. 9d. per ton. The working cost was £41,862, or 24s. 7d. per ton. After allowance for depreciation and London expenses, the net profit was £2417. Owing to the scarcity of native labour, it became necessary to suspend stopping at the beginning of the current year. Since then development has been pressed, but with disappointing results. At the meeting of shareholders held on September 10 it was announced that the ore reserves on June 30 were 16,250 tons at the Thistle and Etna mines and 1500 tons at the Faith claims, and that milling was to be recommenced some time during the month.

Bell Reef.—This company was formed in 1910 for the purpose of developing the Bell gold mine situated in the Gwelo district of Rhodesia. The equipment included a 10-stamp mill with cyanide plant. Recently the Consolidated Gold Fields acquired control. The report now issued covers the year ended March 31, and shows that operations have been confined to development. H. A. Piper reports that the ore reserve was increased from 24,670 tons to 42,495 tons during the year, the average content being 12 dwt. Owing to the presence of antimony, arsenic, and graphite, roasting is requisite to secure a good extraction. At the present time, H. T. Brett is experimenting on the ore with the Martin process, which is a substitute for roasting. Particulars of the process were given in our issue of January 1911. The developments in the mine on the 4th, 5th, and 6th levels were sufficiently satisfactory to warrant the sinking of a new vertical shaft. This shaft is now down 346 ft. and the equipment is completed.

Bechuanaland Copper.—This company was formed in 1909 by the Bechuanaland Exploration Co. for the purpose of acquiring the Bushman and other claims situated 120 miles southwest of Bulawayo. The capital is £135,000 in 10s. shares, and the issue of 100,000

shares was underwritten by L. Hirsch & Co. E. J. P. Jorissen is consulting engineer, and B. F. McDowell is manager at the mine. The development of the deposit of copper ore was commenced a year ago, along the lines recommended by A. J. Fraser, engineer to the Consolidated Gold Fields. The report for the year ended May 31 last shows that altogether 7760 ft. of development work has been done, of which 2548 ft. was done during the year. A number of lenticular ore-bodies have been disclosed, and it is intended to pay special attention to those between the 1st and 2nd levels. Mr. McDowell reports that on the 1st level four separate lenses have a total length of 608 ft., averaging 40 in. wide and carrying from 5 to 17% copper; while on the 2nd level, seven lenses aggregate 597 ft. in length, averaging 50 in. wide, and carrying from 9 to 23% copper. Development on the 3rd level has been hindered by the irregularity of the ore deposit. A parcel of ore has been shipped to England for experimental purposes with a view of ascertaining the best method of extraction.

North Broken Hill.—For a year or two this successful silver-lead mine in New South Wales has suffered from shortness of labour supply, and the output has not been equal to the capacity of the treatment plant. The most recent news however shows that there is now a gradual improvement in this respect. The output and profits have been singularly regular during the last three half-years. The report now issued covers the six months January to June. During this time, 125,415 tons was raised from the mine, of which 26,770 tons came from levels above the 950 ft., 35,564 tons from the 950 ft., 51,351 tons from the 1100 ft., and 11,730 tons from the 1250 ft. The main shaft is down to 1353 ft. and is to be sunk to 1450 ft. before the 1400 ft. level is started. During the six months, 1785 ft. of development work was done, and also 2072 ft. of diamond drilling. George Weir, the manager, does not this half-year give an estimate of the ore reserve; at the end of 1911 the figures were 2,000,000 tons. During the period under review 124,540 tons of ore was treated in the lead-concentration mill, averaging 15.6% lead, 13.2% zinc, and 7.1 oz. silver; the production was 21,129 tons of concentrate averaging 70.5% lead, 6.2% zinc, and 23 oz. silver. The other products included 62,242 tons of zinc tailing averaging 17.8% zinc, 4% lead, and 4 oz. silver, to be treated by the Amalgamated Zinc (De Bavay's), and 8718 tons of slime averaging 13.7% lead, 14.9% zinc, and 9.1 oz. silver. The working cost per ton was: mining 11s. 6d., milling 3s. 7d., development 2s. 1d., total 17s. 2d. This figure is 2s. 7d. per ton higher than during the previous half-year, the rise being due to the increased wages paid. The average earnings of contract miners was 16s. 2d. per shift of 8 hours. The income from the sale of products was £223,647, the working cost was £109,379, administration £3189, placed to reserve £5000, provision for taxes and royalties £7500, and allowance for depreciation £11,910. The dividends absorbed £93,750.

Broken Hill South.—This mine, at the opposite end of the Barrier Range to the North, particulars of which are given in the above paragraph, has also suffered from scarcity of labour, and during the six months January to June to an even greater extent. In spite of this drawback, the profit and dividend have been the highest on record, owing to the increased price of metals. The amount of ore raised was 165,995 tons, averaging 14.3% lead, 13.6% zinc, and 6.5 oz. silver, as compared with 181,562 tons, averaging 14.4% lead, 14.1% zinc, and 6.9 oz. silver, during the previous half-year. Exactly half of the ore came from the

970-ft. level, 21% came from the 1070-ft. level, and the remainder from the upper levels. At the lead-concentration plant, 165,532 tons was treated, yielding 26,630 tons of concentrate, averaging 70% lead, 5.9% zinc, and 23.2 oz. silver; also 125,294 tons of zinc tailing was produced, averaging 2.9% lead, 15.4% zinc, and 3 oz. silver, and 13,448 tons of slime, averaging 10.1% lead, 12.7% zinc, and 5.7 oz. silver. The zinc tailing was sent to the Amalgamated Zinc (De Bavay's) for treatment. It is notable in connection with this tailing that no effort is now made by W. E. Wainright, the manager, to produce a high-grade tailing. It is customary at Broken Hill to make two tailing products, called zinc tailing and quartz tailing respectively, and to discard the latter entirely. The present circumstances at the South mine are such that it is more profitable to aim at a high recovery than to produce a high-grade concentrate. Thus the zinc tailing during the past six months averaged 2.9% lead, 15.4% zinc, and 3 oz. silver, as compared with 3.7% lead, 17.6% zinc, and 3.8 oz. silver during the corresponding months of 1911. In addition to the current output of zinc tailing, 20,171 tons of old tailing has been delivered to the Amalgamated Zinc, and 17,585 tons of old tailing was sent to the Zinc Corporation. The income from the sale of lead concentrate and zinc tailing was £326,967, and the dividends totalled £120,000, being at the rate of 60% for the half-year. The distributions during the two preceding half-years were £90,000 and £60,000. The cost of operation owing to scarcity of labour and higher wages has increased, and was 19s. 8d. per ton including mining, concentration, and development, as compared with 16s. 6d. during the previous half-year. No prospecting or development has yet been done in the South mine in connection with the new orebody discovered some time ago on the property of the Sulphide Corporation at a point immediately adjoining.

Komata Reefs.—This company was originally formed in 1897 to acquire a gold-mining property in the Hauraki mining district, New Zealand. In 1902 part of the adjoining property belonging to the Waite-kauri company was purchased. The mine has been a disappointment, for the dividends have totalled only 10d. per 5s. share, on a capital of 800,000 shares. The report for the year 1911 shows that the policy has been followed of restricting the output and only mining the better-class ore. The tonnage milled was 7582, and the bullion recovered was worth £17,387. The profit was £817. No new ore has been found during the year, and the reserve, at the reduced rate of working, will not last far into 1913. The directors have been in negotiation for another property, but so far have not found a suitable one. The manager is S. D. McMiken, well known as the co-inventor with F. C. Brown of the B.M. vat, otherwise the 'Pachuca.'

Mungana Chillagoe.—This company was formed in Melbourne in 1901 to acquire the Girofla and Lady Jane mines from the Chillagoe company, which still holds a preponderating interest in the share capital. The ore consists chiefly of argentiferous lead and copper sulphides, and also oxides and carbonates, occurring in bunches in limestone. It is treated at the Chillagoe company's smelter. The report for the year ended March 31 last shows that various circumstances have greatly hindered operations. In the first place, the fire in the upper levels of the Lady Jane mine has continued to rage, in spite of three years' efforts to extinguish it. At the Girofla mine the workings were flooded between the time the old pump was removed and the new plant started. Just as the change was being made, a serious wash-out happened on the Cairns

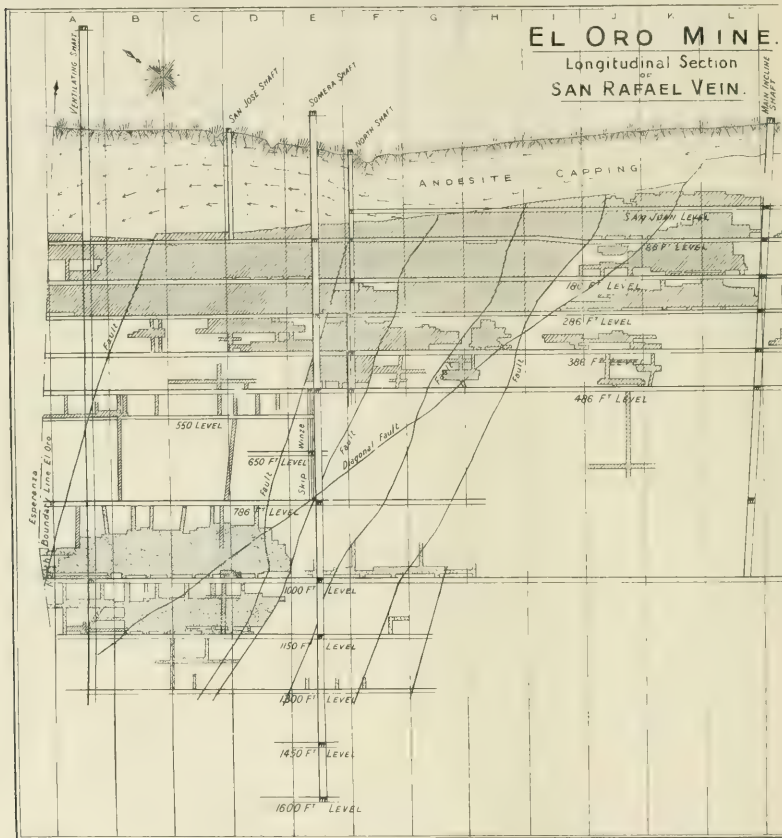
railway, and the delivery of the spur-wheel, the only part of the machinery still wanted, was delayed for three months. In the meantime heavy rains supervened, and it became necessary to resort to bailing. The damage done thereby to the main shaft was so great that the top 200 ft. had to be subsequently re- timbered. The new pumps were required in connection with the sinking of the main shaft, undertaken for the purpose of developing the deep levels of the mine to a depth of 2000 ft. During the year 8968 tons of ore was raised from the Girofla, chiefly low-grade flux and lead sulphide. At the Lady Jane, 1430 tons of ore was raised from the levels below the fire zone, assaying 15.93% copper, 15.79% lead, and 17.9 oz. silver per ton. The revenue from the sale of ore was £12,106, and the net loss was £16,002. It has been decided to flood the upper workings of the Lady Jane in order to extinguish the fire. Since the close of the company's financial year, a reconstruction has been effected, and £25,000 additional capital raised. The new company is called the Mungana Mining Co., Ltd.

Porco Tin Mines.—This company has been formed with a capital of £125,000 for the purpose of developing the Porco tin mines, which have been worked in a small way for some years. The property is close to the branch line of the Antofagasta railway connecting with Potosi, and is 25 miles from that city. The original owner is Arturo Arana, of Sucre, and the introducers are José Richards and James Edwards, the latter being well known as the secretary of the Great Boulder Proprietary. The firm of Avelino Aramayo & Co. are the commercial agents; they are the owners of the Aramayo Francke mines at Chorolque, 100 or so miles to the south toward Tupiza. Edward Hooper is a member of the board of directors. Reports on the property have been made by José Richards, by O. Gore Adams, the manager of the Llallagua tin mine near Oruro, and by Bruce Marriott & Co. That of the first named is used as the basis of the prospectus. He estimates the ore reserve at the various workings at 45,000 tons, averaging 4.4% black tin. The cost of mining and concentration is given as £32 per ton of metallic tin, and the cost of freight and smelters' charges in England £28. There is a 10-stamp mill on the property, and it is first proposed to improve this and the accompanying dressing plant. A new mill of 20 stamps is to be erected with a capacity of 60 tons per day. The mine had been worked chiefly for silver in earlier days, and much tin ore has been left in the old stopes.

Aporoma Goldfields.—This company was formed in May 1910 to develop the gold-gravel property of the Aporoma Exploration Syndicate, situated in the province of Sandia, in the southeast of Peru. The gravel was worked many years ago by natives and by Spaniards, and their ditches are still of some engineering importance. Merricks, Crane & Co. are the engineers. The report now issued covers the period from the date of formation of the company to March 31 last. It shows that work was commenced in December 1910 in connection with the water-supply, and part of the work and the treatment plant was sufficiently forward to start hydraulicking in February last. Unfortunately an unprecedented dry season then supervened, and regular work has not been possible since. However, a test clean-up was made on December 31 on 6000 cu. yd. of gravel, which yielded 46 oz. gold, or 8d. per cubic yard. The gravel washed came from the upper part of the face, which is 200 ft. high, so that the yield will probably be increased when the lower portions are worked as well. A mule-road from Phara, a distance of 35 miles, has been built. The deposit covers

2 square miles and varies in thickness from 50 to 400 ft. The directors report that the capital subscribed has not been sufficient, and that they and the chief shareholders have provided the additional necessary funds. The issued capital of the company is 266,107 shares of £1 each. The purchase price was £15,000 in cash and £147,200 in shares. The cost of treatment is estimated at 2d. per cubic yard.

he recommended a reduction in the rate of extraction of the ore. The results of this policy are shown in the report for the year ended June 30 last. The net realized profit was £182,149, as compared with £216,430 during the previous twelve months, and the dividends totalled £143,437 as compared with £172,125. The amount of ore treated was 302,698 tons as compared with 360,294 tons. In addition, 84,459 tons of accumu-



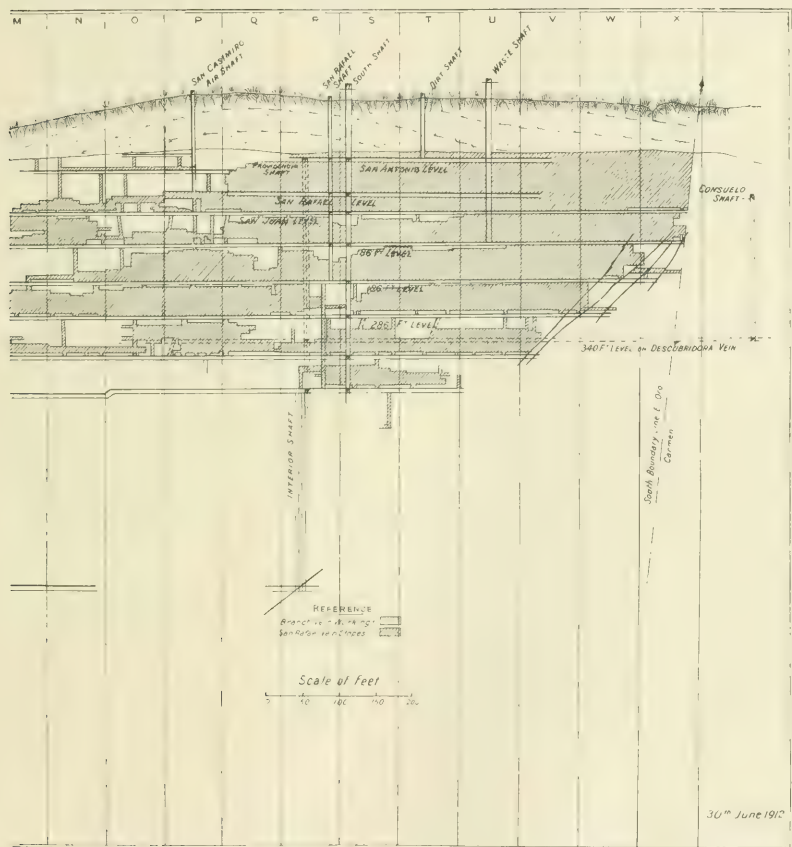
LONGITUDINAL SECTION OF SAN

El Oro Mining & Railway.—At the beginning of the year 1912, the chairman, R. T. Bayliss, announced that the stopes in the upper portion of the San Rafael vein at this celebrated Mexican gold mine could not maintain the current output of ore for more than three years. In order that a regular output should be maintained for a sufficiently long time until the deeper levels were explored and developed on a large scale,

lated sandy tailing was re-ground in the tube-mills and sent to the cyanide plant. It was decided to start the re-treatment of this tailing in order to maintain the tonnage passing through the tube-mills and vats. There still remains 378,279 tons of this material. The assay-value of the ore treated was \$6.36 gold and \$1.30 silver, and of the tailing re-treated \$2.68 gold and \$0.88 silver. The bullion realized £454,582 and the

mining expenditure was £299,222. A profit of £23,868 was made on the railway; London expenses and directors' fees were £5006, and £25,000 was written off the value of plant. It is estimated that the ore reserve on June 30 was 301,934 tons averaging \$7.46 gold and 3 oz. silver per ton, as compared with 484,139 tons a year ago. A. F. Main, the manager, gives details of the exploration and development work done during the

North Anantapur.—This company was formed in June 1908 by John Taylor & Sons for the purpose of acquiring a partly developed gold-mining property in the State of Mysore, India, from the Anantapur Gold Fields. Production commenced in May 1910. The report now issued covers the year ended June 30. During this period 17,568 short tons of ore was milled yielding gold worth £24,152. This was an increase as com-



RAFAEL VEIN, EL ORO MINE.

year. Unexpected discoveries of ore have been made in the upper portion of the south end of the mine, and the results obtained by the further development of the Branch vein on the 1150-ft. and 1300-ft. levels are sufficiently encouraging. On the 1450-ft. and 1600-ft. levels not enough work has been done to justify any expression of opinion. The mill is now regularly treating 20,000 tons of ore and 15,000 tons of tailing per month.

pared with last year of 4820 tons and £5500. The average grade of the ore treated steadily increased from 5 dwt. to 10 dwt. during the year. More ore would have been milled had it not been for the exceptionally dry season. To guarantee a regular supply of water in future, a pumping station and reservoir are being built $1\frac{1}{2}$ miles away from the mine. The accounts show receipts £24,296 and expenditure £25,170.

and in addition £1503 was written off for depreciation. L. C. Oliver, the superintendent, in his review of development work, shows that the ore reserve has been increased from 14,000 to 42,000 tons. The ore-shoot that was first discovered in the 150-ft. level north of No. 5 shaft has been intersected by the 450-ft. level north of the North shaft. In this lower level the ore-body has been proved for 283 ft., and cross-cuts have shown it to be as much as 57 ft. wide at one place. The average width of the level is 4 ft., and across this width the assay-value was 25 dwt. A winze below the level is 75 ft. deep and is still in ore of the same quality. The outlook is so satisfactory that 10 additional stamps are to be erected, bringing the total to 30, having a capacity of 3000 tons per month. A tailing plant is being provided, and a new winding-engine capable of hoisting ore from 2000 ft. is nearly completed. To provide funds for this expansion of operations, 25,000 preference shares of £1 each were issued last October and absorbed by shareholders.

Pusing Bharu Tin Mines.—This company was formed in 1907 to acquire a tin-gravel property in the district of Kinta, Federated Malay States. An electric power-plant has been erected, owned conjointly with the Siputeh company. Dividends commenced in 1910. The report for 1911 now published shows that the yield was 413 tons of black tin, which sold for £47,106, or £114 1s. 2d. per ton. In addition the sum of £1282 was received from tributors. The mining cost was £29,770, London and other general expenses £1001, allowances for depreciation £2627, profit £14,137; £3000 has been placed to reserve, and £12,000 distributed as dividend, being at the rate of 15%. W. A. Luning is chairman of the company, and W. H. Knapp is mine manager.

Rooiberg Minerals.—This company was formed in the Transvaal in May 1908 for the purpose of reopening ancient tin mines in the Rooiberg range, 40 miles by road from Warmbaths station, and 75 miles north-west of Pretoria. The control was originally with the Oceana company, but passed later to the Anglo-French Exploration group. Edward J. Way is consulting engineer, Edward R. Schoch is general manager, and Amos Treloar is manager of the dressing plant. Operations started with 10 stamps; and in May of this year an additional 10 stamps were brought into use, together with treatment plant for accumulated middling and slime. During the year ended June 30, the old stamps treated 18,295 short tons of ore, and the new stamps 2504 tons, of which 789 tons was accumulated middling and slime. The total amount treated was 20,799 tons, and the yield of concentrate was 844'58 short tons, equal to 789 8 long tons. The average metallic content was 67.89%, and the recovery was 57.97%. The reserve of middling and slime to be re-treated on June 30 was 44,485 tons having an average assay-value of 2.51% metallic tin. A Brunton roasting furnace and a magnetic separator have been provided, and by their means the content and quality of the concentrate will be increased. As regards the development work done during the year, Mr. Schoch reports that owing to the irregularity of the deposit it is impossible to give a dependable estimate of ore reserve, but he states that the disclosures of profitable ore continue to be made. His figure for the ore reserve on June 30 was 21,300 tons, with a recovery-value of 4.7% metallic tin. He mentions also that the content per ton treated has been less than during the previous year and that it will probably remain at this lower level, the reason being that the dumps containing high-grade material are approaching exhaustion. The sale of concentrate during the year brought an

income of £105,617 and the profit was £33,547. Out of this, £27,000 has been distributed as dividend at the rate of 15%.

TRADE NOTES

Most of the trade publications mentioned in this column are available for distribution and the manager of The Mining Magazine will be pleased to secure copies for persons interested.

The Nordberg Manufacturing Co. devote bulletins Nos. 20 and 21 to descriptions of the 'S. C. Belted Type Compressor' and 'Nordberg Uniflow (Corliss type) Engine.'

Sandycroft, Ltd., have issued two timely bulletins giving further particulars on the special features and applications of 'Cascade Motors.' We understand that recent orders for these motors are taxing the works to their utmost capacity.

The Dodge Manufacturing Co. publish their trade catalogue and price-list in the form of a cloth-bound book of 416 pages with an excellent index. They manufacture Power-Transmission Machinery, that is, Pulleys, Clutches, Pillow-blocks, Shafting, etc.

J. Pohlig, Ltd., have now issued an English edition of their catalogue describing and illustrating the 'Otto' system of Aerial Ropeways. Nothing is as likely to interest intending purchasers as actual views of installations, and this catalogue is notable for the number and quality of these illustrations. A special pamphlet is also issued, illustrating an aerial tramway 15 kilometres in length used for transporting timber in the Transylvanian Alps.

Fraser & Chalmers' August 1912 bulletin deals with 'Standard Stamp-Mills' and, as explained on the first page, the word 'Standard' is intended to differentiate from 'sectionalized' batteries. The 'New' Blanton self-tightening cam is given the prominence it deserves. It will be recalled that Fraser & Chalmers were the first to introduce this valuable invention in connection with stamp-mills.

Fraser & Chalmers, Ltd., gave the members of the Institute of Metals an opportunity of seeing their works at Erith, Kent, on September 25. The work under construction is keeping the 1300 employees fully occupied, and the 18 acres of floor-space represents an animated and varied scene of activity especially interesting to mining engineers who have not had the opportunity of seeing mining machinery in the making.

We acknowledge receipt of bulletins and catalogues for our files from the following:

Atlas Car & Manufacturing Co.;
Blake & Knowles Steam Pump Co.;
Diamond Rubber Co.;
Deane Steam Pump Co.;
Fairbanks, Morse & Co.;
Holly Manufacturing Co.;
International Gas Engine Co.;
Jeanesville Co.;
Laidlaw Dunn Gordon Co.;
Ludlow-Taylor Wire Co.;
Lunkenheimer Co.;
Merrell Manufacturing Co.;
Power Mining Machinery Co.;
Prescot Steam Pump Co.;
Snow Steam Pump Works;
Standard Diamond Drill Co.;
Stearns Roger Manufacturing Co.;
Thew Automatic Shovel Co.;
Worthington Pump Co., Ltd.

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Scientia non habet inimicum nisi ignorantem.

T. A. RICKARD, Editor.

EDGAR RICKARD, Managing Director.

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C O N T E N T S.

	PAGE		PAGE
STATISTICS OF PRODUCTION.....	316	DISCUSSION	
REVIEW OF MINING.....	317	Institutes as Publishers.....	351
EDITORIAL		.....<i>Francis Drake</i>	351
Notes.....	323	M.I.M.M or M.I.C.E.....	<i>M.I.C.E.</i> 351
The American Election.....	325	Unreliability of Ore-Tests <i>E. S. King</i>	351
A New Group.....	326	The Engineer in the Tropics <i>W.H.E.</i>	352
Processes and Publicity.....	328	Rand Problems.....	353
Anglo-Continental.....	329	.....<i>Africanus Olim Et Semper</i>	353
Photo-chemical Effects.....	331	Debentures in Mining.....	354
Dredging in Frozen Ground.....	332	.....<i>Morton Webber</i>	354
Definitions.....	334		
Phantom Profits.....	335	PRÉCIS OF TECHNOLOGY	
SPECIAL CORRESPONDENCE		Photolyse.....	377
Lima.....	337	Decomposition of Sulphates.....	377
Kalgoorlie.....	338	Prospective Lives of Witwatersrand	
Toronto.....	340	Mine.....	377
Camborne.....	342	Drag Classifier.....	378
San Francisco.....	344	Air-Cushion Stamp in Australia.....	379
Johannesburg.....	346	Fluor-Spar in England.....	379
Melbourne.....	349	Fume Filters.....	380
PERSONAL.....	356	Mining Methods at Nacozari.....	380
METAL MARKETS.....	362	Corrugated Ships.....	381
ARTICLES		Estimating Tonnage of Sand.....	382
Gossan Outcrops of Cupriferous Pyrite		Sun-Power.....	382
..... <i>H. W. Turner</i>	357	CURRENT LITERATURE.....	382
Prospecting for Tin in Nigeria.....		BOOKS REVIEWED.....	383
..... <i>John T. Keating</i>	363	COMPANY REPORTS.....	385
Premier Diamond Mine <i>Ralph Stokes</i>	366	TRADE NOTES.....	392

STATISTICS

STOCKS OF COPPER IN ENGLAND AND THE CONTINENT.
Reported by Henry R. Merton & Co. Tons of 2,240 lb

	Aug. 31. Tons	Sept 30 Tons	Oct. 31 Tons
In England	39,550	29,549	28,377
In France	7,886	7,584	6,923
Afloat from Chile	2,660	1,825	2,100
Afloat from Australia	5,660	5,250	5,600
In Rotterdam	570	450	700
In Hamburg	4,126	4,287	2,341
Total European visible supply	50,332	47,915	46,311

AMERICAN COPPER PRODUCERS' ASSOCIATION'S FIGURES.
In Tons of 2,240 lb.

	Production.		Deliveries		Stocks at end of month
	Tons	Domes- tic	Foreign	Total	
Total, 1911	639,258	316,791	337,009	653,800	39,937
January 1912	53,272	27,832	35,789	63,621	29,589
February	51,801	25,101	28,191	53,292	28,098
March	56,114	30,123	26,241	56,369	27,843
April	56,011	31,033	23,773	54,806	29,048
May	56,570	32,456	31,020	63,476	22,142
June	54,605	29,521	27,153	56,695	19,792
July	61,233	31,738	26,840	58,578	22,147
August	65,013	35,144	31,467	66,611	20,840
September	62,540	28,330	26,904	55,234	28,155
October	64,913	37,546	21,259	58,806	34,262

PRODUCTION OF GOLD IN THE TRANSVAAL

	Rand	Else- where	Total	Value
	Oz.	Oz.	Oz.	£
January 1912	709,280	27,780	737,360	3,130,830
February	674,960	28,906	703,866	2,989,832
March	746,735	33,968	780,723	3,235,688
April	706,763	30,897	737,660	3,133,383
May	746,488	32,714	779,662	3,311,794
June	722,588	31,348	753,936	3,202,517
July	735,941	30,397	766,338	3,255,198
August	732,197	32,540	764,737	3,248,395
September	718,495	31,398	747,893	3,176,846
October	738,082	30,599	768,681	3,265,150

* Including 70,143 oz. worth £297,946 extinguished reserve.

COST AND PROFIT ON THE RAND.

	Tons	Yield per ton	Cost per ton	Profit per ton	Total profit
		s. d.	s. d.	s. d.	£
1911	23,888,260	27 7	18 0	9 7	11,414,863
January 1912	2,067,161	27 6	18 10	8 11	997,557
February	1,980,396	28 3	19 2	9 2	907,192
March	2,163,998	25 1	18 11	9 0	1,334,764
April	2,059,562	28 6	19 0	9 8	1,005,920
May	2,177,348	28 0	18 9	9 10	1,073,534
June	2,110,657	28 5	18 6	10 1	1,063,634
July	2,149,785	28 6	18 8	9 11	1,061,089
August	2,121,155	28 4	18 10	10 0	1,055,315
September	2,081,295	28 7	18 8	10 0	1,040,820

NATIVES EMPLOYED IN THE TRANSVAAL MINES.

	Gold mines	Coal mines	Diamond mines	Total
January 31, 1912	184,046	7,805	9,524	201,375
February 29	190,320	7,922	10,789	209,301
March 31	186,748	8,198	12,071	217,017
April 30	197,937	8,361	13,785	220,086
May 31	193,829	8,461	15,318	217,627
June 30	188,494	8,549	15,530	212,573
July 30	182,925	8,497	15,814	207,256
August 31	179,111	8,766	15,934	203,811
September 30	180,799	8,783	15,752	205,274
October 31	182,038	8,803	15,496	206,357

GOLD OUTPUT OF INDIA.

Year 1910	Year 1911	Oct. 1912	Year 1912
£2,104,858	£2,150,050	£189,448	£1,870,828

PRODUCTION OF GOLD IN RHODESIA.

MONTH.	1908	1909	1910	1912
	£	£	£	£
January	199,388	204,666	227,511	214,918
February	191,635	192,497	203,888	209,744
March	200,615	202,157	228,385	215,102
April	212,935	222,700	228,213	221,476
May	223,867	225,052	224,888	234,407
June	224,920	217,600	214,799	228,867
July	228,151	225,234	195,233	204,514
August	230,792	228,296	191,423	239,077
September	204,262	213,249	178,950	230,573
October	205,466	222,653	234,928	-
November	196,668	236,307	240,573	-
December	217,316	235,397	199,500	-
Totals	2,526,007	2,623,788	2,568,301	-

PRODUCTION OF GOLD IN WEST AFRICA.

MONTH.	1910		1911		1912	
	Oz.	Value	Oz.	Value	Oz.	Value
January	17,357	70,699	15,903	66,107	26,098	107,262
February	16,976	68,469	15,179	63,081	25,000	102,270
March	17,627	71,954	16,387	67,673	27,228	111,376
April	16,363	67,069	17,237	70,880	27,790	114,796
May	16,590	68,335	24,427	96,400	28,015	115,678
June	17,194	70,988	22,555	92,174	27,784	114,697
July	15,561	58,551	22,510	91,955	30,974	127,800
August	13,921	57,713	25,385	103,753	33,015	136,407
September	11,497	47,746	26,717	109,039	34,491	142,397
October	13,341	55,046	26,826	107,503	-	-
November	14,021	57,658	24,289	99,299	-	-
December	15,042	61,737	24,304	99,569	-	-
Totals	185,493	755,985	261,784	1,069,412	-	-

PRODUCTION OF GOLD IN WESTERN AUSTRALIA.

	Export oz.	Mint oz.	Total oz.	Total value £
Total, 1910	363,496	1,209,856	1,573,352	6,682,042
Total, 1911	160,021	1,210,447	1,370,468	5,823,522
January 1912	10,697	95,673	106,370	451,828
February	10,441	92,091	102,532	415,526
March	408	92,597	93,005	395,058
April	10,698	99,708	110,406	468,972
May	9,288	98,104	107,392	456,170
June	1,214	106,930	108,144	459,605
July	8,802	96,838	105,640	448,728
August	7,262	101,377	108,639	461,466
September	1,580	109,525	111,105	473,170
October	10,288	95,977	106,265	451,342

OTHER AUSTRALASIAN GOLD PRODUCTION.

	1910	1911	October 1912	1912
Queensland	1,840,337	1,623,390	124,520*	1,120,190*
New South Wales	803,727	704,353	65,592	583,495
New Zealand	1,896,322	1,808,049	80,125	1,188,793
Victoria	2,422,700	2,138,000	175,600	1,511,000

* September figures only.

SALE OF TIN CONCENTRATE AT REDRUTH TICKETINGS.

	Tons	Value	Average
Year 1911	61514	£702,599	£114 4 5
Jan. to August 1912	42362	£511,195	£120 8 8
September 2	2284	£30,333	£134 13 4
September 10	287	£10,000	£136 17 9
September 30	2188	£33,505	£140 0 3
October 11	251	£33,518	£143 10 9
October 28	294	£43,909	£141 11 11

EXPORTS OF TIN AND ORE FROM STRAITS AND BOLIVIA
Reported by A. STRAUS & Co

	1911 tons	Oct. 1912 tons	1912 tons
Metal from Straits to Europe and America	55,115	4,175	48,393
Metallic Content from Bolivia to Europe	25,577	1,849	17,460

REVIEW OF MINING

INTRODUCTORY.—At the time when we went to press in October the Balkan crisis overshadowed the bourses of Europe. Montenegro had just declared war. Paris and Berlin were fearful of a financial panic. It came, but it proved short-lived. The wreckage was cleared without a general demoralization of the markets. Several firms were 'hammered' on our Stock Exchange and sundry failures followed the settlements at Paris and Berlin, but once these funerals had received proper attention, the spirits of the survivors recovered. Since then a cheerful tone has ruled. The splendid success of the Balkan States and the utter collapse of the Turkish military power have come so quickly as to presage an early cessation of hostilities. That has encouraged optimism on the exchanges. Moreover, the so-called Great Powers have exhibited unexpected sagacity in accepting the logic of facts so that any blundering interference with the combatants has been avoided. International complications seem, for the moment, unlikely. The recent American election has settled the dust of political controversy and turned attention anew to industrial activity. This presages the use of the base metals. In South Africa the Modderfontein development has heartened mining operators. In Mexico the outlook is still darkened by disorder, but hope of betterment is strong. In Australasia the labour troubles are being settled and the base-metal mines are going strong. Oil is receiving renewed attention. On the whole, the mining markets are in a healthy condition; if the Balkan war should end soon, we shall expect a further revival of business.

TRANSVAAL.—The September statistics, announced as usual on the tenth day of the following month, exhibited nothing abnormal. The slight decrease in the gold output was due

entirely to the loss of a day, as compared with August. The labour supply showed a gain of 1628, but this was expected, the seasonal migration being at an end. The total number of natives employed on gold mines at the end of September was 180,739, as against 179,619 at the same date last year. During October a further gain of 1319 is recorded, and it appears that the return movement of natives to the mines is now established for six or seven months.

The Far East Rand is again to the front with an excellent item of news, the New Modderfontein announcing the intersection of the lode by the circular shaft at 2158 feet on October 29. The average assay over a width of 42 inches is 26·9 dwt. per ton. A later cablegram gives the average of ore as 30 dwt. for 21 inches, while the whole lode, including partings, assays 13·2 dwt. per ton for a width of 48 inches. This news stimulated the Kaffir market, as might be expected.

Interest in the Premier diamond mine is heightened by the discovery of another large stone, said to weigh 1649 carats. But such abnormal diamonds are not so big a source of profit as is generally assumed. The Transvaal Government paid £100,000 for the Cullinan, which was presented to King Edward. Allowing for the Government's profit, which was waived in this case, of 60%, the price was relatively small. On another page we publish a most timely article on the Premier mine by Mr. Ralph Stokes.

Increased activity is reported from Pilgrim's Rest, due chiefly to the successful operations of half-a-dozen small workers, with 5-stamp mills, on the ground surrounded by the horse-shoe-shaped concession of the Transvaal Gold Mining Estates, an Eckstein affair, which, with 60 stamps, is paying about 6s. per share

per annum on its capital of 640,000 shares. It is proposed to amalgamate the small holdings with the concession, into a company to be capitalized at £150,000, of which £35,000 will be working capital. The lode consists of about one foot of quartz mixed with manganese oxides, which hindered the earlier efforts at amalgamation and therefore delayed exploitation until cyanidation proved adaptable. The average yield is claimed to be 10 dwt. gold per ton. Owing to the steep contours of this hilly district it is possible to reach the ore by means of adits, all the existing workings having been opened up in this way. The proposed property is estimated to cover 450 claims and to contain 1,500,000 tons of 10 dwt. ore, according to reports by Messrs. J. B. Thorburn, H. F. Olds, and A. Von Dessauer.

According to a report by Mr. J. M. Calderwood, consulting engineer to the Messina copper mine, the reserve in that property is 170,000 of 10% copper ore, besides 330,000 tons of possible ore, down to the 10th level. The railway is expected to be finished in May next. When this is done and the new mill is erected, the profit, on an output of 10,000 tons monthly, is estimated officially at £240,000 per annum, with copper at £75 per ton. Undoubtedly the prospects are excellent, for extensive ancient workings promise the discovery of further orebodies on both sides of the present mine.

RHODESIA.—In September the gold output was 54,774 ounces, a decrease of 2051 oz. as compared with August, although the number of productive mines was augmented from 182 to 186. The Gaika, Jumbo, and Lonely Reef mines gave an increased yield, but as this was slight in the aggregate, it was more than overcome by the small decreases at the Globe & Phoenix, Giant, Eldorado, and Charterland mines. Of course, the shorter month affected the output, and so did the drought, which at last gives signs of being broken by the rains.

Metallurgical difficulties will delay the pro-

duction of gold from the Cam & Motor mines, recent experimental work having proved that the plant as originally designed is not suitable. The plant involved ball-mills, roasting, mixing with cyanide solution, classification again, followed by leaching of the sand and filtering of the slime. It has been ascertained, however, that this treatment will not do, by reason of the presence of both the carbonate and sulphate of lime in the ore. By reaction with the sulphur liberated during roasting, the carbonate is changed to a sulphate, causing the roasted product to 'set,' like cement, whenever it comes to rest in the various parts of the mill. This difficulty is not unknown to cyaniders, for it was overcome at Kalgoorlie, for a time, at least, by the adoption of the bromo-cyanide process, which obviates roasting. Subsequently the mine workings penetrated below the shallow zone marked by the presence of this refractory material, and it ceased to trouble the millmen. During the period when gypsum was present in the ore, it was necessary, on several occasions, at the Lake View, Hannan's Star, and the Brown Hill, to remove the cemented ore by blasting. It is a fortunate coincidence that some of the metallurgists formerly at Kalgoorlie are now in Rhodesia, and their services are being utilized by the Cam & Motor Company. We may mention Messrs. R. W. Allen, John Manners, and H. T. Brett. It is likely that the effect of the lime products will be overcome by following the practice evolved in Western Australia, where the most practicable method was found to be an extra effort to keep the pulp in constant motion by means of an all-slimes process, supplemented after roasting by mixing with solution, classification by a series of small spitzkasten, with grinding of the coarse in pans, the resultant slime being agitated before filter-pressing. The use of a number of small spitzkasten must be emphasized, for this was the distinctive feature whereby a small part of the plant could be choked temporarily without the blocking of

the entire series of operations. The net result of this modification in the treatment is an inevitable increase in the cost of milling.

The ore reserve in the Eldorado on September 30 is given as 123,000 tons, valued at £390,502. This compares with 149,746 tons, valued at £476,191 on March 31. The decrease is due to the shorter length of the ore-body on the 7th, 8th, and 9th levels as compared with the upper levels. This confirms the opinions expressed in our August issue.

The Falcon Mines issues its annual report, indicating favourable results from development. No details are given concerning the metallurgical treatment of the gold-bearing copper-ore. This is not a simple matter, by any means. It is stated that plant to treat 600 tons daily is to be completed by the end of 1913. The new estimate of ore in reserve indicates that the figures published with the prospectus, a year ago, were generously inaccurate. Then the ore above the 5th level was given as "slightly under a million tons" and worth "not less than £1,276,000." Although no ore has been extracted, it is now stated that the reserve, in June 1912, above the 5th level is 730,000 tons, valued at £1,757,000, and this includes 100,000 tons between the 5th and 6th levels. Mr. A. J. Fraser's estimate for the ore above the 5th level is 629,877 tons, valued at £1,457,000.

The Pickstone mine, in the Hartley district, is fulfilling its promise. Two Tremain stamps have been crushing about 500 tons per month, or 1000 tons during August and September, yielding a total of 1500 oz. gold. Most of this comes from development. It is proposed to erect 10 stamps, of 1250 lb. each, at once, re-crushing the pulp under three Akron Chilean mills, previous to cyanidation. The workings are only 126 feet deep, exposing two lodes, one of which has just been cut while the other has been followed for 800 feet at the first level, showing an average of 30 inches of ore. The company is capitalized for £50,000.

The announcement of a much reduced dividend by the Consolidated Gold Fields had a depressing effect. Last year this financial house paid 6s. per share; this year the dividend is only 3s. 6d. Of course, the times have been bad for share-dealing and the promotion of new issues, but the Gold Fields has suffered more than other houses from its participation in West African mines, on which large sums of money have been expended unprofitably. Moreover, this group has declined in public esteem by its administration of mines in Rhodesia, and by its performances in the Nigerian tin market.

WEST AFRICA.—The output of gold in September was 34,491 ounces, worth £142,397. This is the best recorded, and is 1476 ounces more than in August. The Abbontiakoon has increased its yield to £14,153. Slight gains were made by several mines, namely, the Abosso, Bibiani, Prestea, and Taquah. Both of the dredging companies did better, the Offin River yielding £3600, while £1200 came from the Ancobra.

The Naraguta's annual report is fairly satisfactory, showing a yield of 560 tons of black tin, as against 551 during the preceding 14 months. The manager, Mr. F. O'D. Bourke, estimates that the life of the mine is at least 20 years and the amount of cassiterite or black tin assured he puts at 10,000 tons, not counting the possible yield from an area of 14 square miles yet to be tested. It would be well if these statements were confirmed by an outside engineer.

The Colonial Office announces that arrangements have been made for a systematic survey of the tin region in Northern Nigeria, and until that survey is well advanced, no more exclusive prospecting licenses are to be issued and no more mining leases granted, except in the case of applicants for exclusive licenses who had left for Nigeria on or before October 16, or of applicants for leases who are entitled to them by virtue of their prospecting

licenses. This looks as if the authorities were prepared to hinder the flotation of wild-cats and had awakened tardily to the fact that their regulations have facilitated the perpetration of swindles. We hope the surveying party includes some thoroughly experienced men, otherwise the work will be futile.

At the Abosso and Taquah a noble effort is being made to reduce the working cost. And not without success, for at the Abosso the cost has been reduced during the past year from 34s. to 26s. per ton. These figures include development-redemption and London expenses. Mr. J. W. Newbery is entitled to credit for this performance.

The chairman of the North Tarkwa Syndicate, Mr. John C. Sanderson, did well in explaining to the shareholders that bore-holes, especially a solitary one, do not afford convincing evidence concerning the average assay-value of a lode, but he was entitled to be cheerful over the promising result obtained at 1066 feet, from the drilling operations recommended by Mr. Walter Broadbridge.

Large statements by resident superintendents and managers should always be verified as early as possible. For instance, Mr. T. Bowyer Bower states that he has proved "a huge gold-bearing ore mass" at Miradani. This ought to be confirmed or corrected by Mr. Arthur Wilkinson, the company's consulting engineer.

AUSTRALASIA—The effect of labour troubles is still manifest. Early in October a resumption of work was attempted with a small force at Waihi. Only 250, out of the full complement of 1500, are employed. About 400 tons daily is now being milled, mostly ore broken before the strike. Pumping has only recently commenced. A general clean-up in the mill has yielded £50,000. The referendum to the shareholders, on the question of acquiring other properties with the cash in hand, has resulted in 156,513 shares approving of this idea, as against 71,539 shares opposing.

Acting on this expression of opinion, the directors are investigating several properties. At the Talisman also, a resumption of mining and milling has been rendered possible by receipt of fuel, on the termination of the coal strike in Australia.

On October 12 a fire on the 700-ft. level of the North Mount Lyell mine led to the imprisonment underground of 90 men. The smoke spread through the workings and suffocated many miners. Compressed air was pumped continuously into the mine in order to help the survivors, of whom 38 were gathered at the 1000-ft. level. These were rescued on October 16. The death-roll includes 42 men. All accounts agree in praising the energy shown by the officials in extricating the survivors of the disaster. The fumes hindered their efforts and finally caused the abandonment of further search. Attempts to extinguish the fire failed. On October 22, at a conference of directors, the management, and the Inspector of Mines it was resolved to flood the mine, as the only means of extinguishing the fire. This does not affect the chemical works nor the Mount Lyell mine itself. Pending the recovery of the North mine, it is proposed to extract ore from the Tharsis open-cut and the Comstock workings.

RUSSIA.—Early in October telegrams from the Kyshtim announced the cutting, in two boreholes, of copper ore exceptionally rich in gold. Assays of 3 oz. per ton were reported in one case. These boreholes penetrate the new Amerikansky orebody, lying midway between productive mines belonging to the Kyshtim Corporation. A later telegram, received on November 6, states that a third borehole, at a depth of 355 feet, has cut ore assaying, for 20 ft. wide, 2'36% copper, 2 dwt. gold, and 16 dwt. silver. Besides this 12 inches of ore on the foot-wall averages 9'6 dwt. gold. The length of ore proved at this locality is now 350 feet. It may be added that the high assays first reported are attributable to sporadic

patches of tennantite, a sulph-arsenide of copper, which at Kyshtim is specially associated with gold and quartz. At the Amerikansky each borehole has shown a large width of quartz on the foot-wall. It is also noteworthy that the proportion of tennantite has increased in depth. The first dividend, at the rate of 1s. per share, has been declared.

The Orsk Goldfields has ceased to give the necessary information concerning its operations, for the yardage is omitted. This important detail was given for several months after the dredge started. In September the output of gold was less, but the cost also was less. The profit from the Kolchan dredge has been declining since June. The plant at Pokrovsky is idle, pending a conversion of the stacker-scow into a dredge. The profit for the season up to date is given as £26,385, but this excludes charges for administration and royalty, both of which are unknown quantities.

MEXICO.—While the smart suppression of the Vera Cruz outbreak is a good sign, we regret to chronicle further acts of brigandage. The Velardeña mines, in Durango, were looted recently; also the Rio Tinto smelter in Chihuahua. At Batopilas 13,000 pesos was taken by bandits posing as revolutionists. At El Tigre, in Sonora, the town was attacked by so-called rebels, and despite assistance from 380 Federal troops, the place had to be abandoned. The bandits took 21 bars of bullion, valued at \$25,000, but this has been recovered. The loss in stores amounted to \$15,000.

We note that the Palmarejo mine continues idle, owing to the unsettled state of the country. According to the latest estimate of the manager, Mr. G. E. Stephenson, the ore assured amounts to 318,849 tons, with 255,438 tons partly developed. The estimated net profit assured is put at £355,932. While this money lies locked in the earth, the interest on debentures must be paid regularly. Fortunately no injury can be done to the assets,

but the delay in production is irritating, having regard to the fact that the company appeared to be ready to commence profitable exploitation.

El Oro shares have risen, presumably on the announcement that the company had acquired the Ofir block, a small property lying between the Somera and Esperanza claims. This purchase involves no increase in the El Oro company's capital.

News coming from Mexico concerning the Santa Gertrudis is contradictory, for the facts admit of diverse interpretation. In sinking to the 19th level the lode where first intersected, in the cross-cut from the Counter shaft, was poor; in driving upon it eastward it got into fine ore near the Barron boundary, but westward for some distance it was poor. The corresponding ground on the 18th level was not particularly good, but it was better than this part of the 19th level. However, in the west end the cross-cut from the San Guillermo shaft cut good ore and has followed it eastward, so that no general impoverishment is proved. As it is proposed to lower the grade of ore sent to the mill, it may be surmised that the management is prepared to face altered conditions. An old shaft in the patio of the Guadalupe hacienda was recently uncovered, disclosing a fair width of profitable ore. This is in Pachuca itself, three miles from the Santa Gertrudis mine.

UNITED STATES.—The old Camp Bird is still alive. In June its resources were estimated at £61,000. An orebody has been found between the third and fourth levels east, below the adit. The ore averages \$25. Judging from experience this find is not likely to revive the waning energies of the mine, but it is satisfactory nevertheless. The earnings for the year were \$1,134,006 from a gross output of \$1,742,137. Another year will probably see the end of operations at this mine, but it will have made a glorious record.

It is announced from New York that the

Kennecott Mines Co. has declared a \$2,000,000 dividend, making no less than \$3,000,000 paid during 18 months on a capitalization of \$2,500,000. This looks like good business. Kennecott is the name of the Guggenheim-Morgan company controlling the celebrated Bonanza copper mine in the Copper River district, Alaska. It was organized in 1907 and is officially administered by the American Smelting & Refining Co., New York. The Bonanza mine contains one of the most remarkable orebodies ever found by the prospector, the outcrop being on the crest of a mountain overlooking the Kennecott river, a tributary of the Chitina, which flows into the Copper river. At one time the anticipation of a big output of copper from this mine threatened the metal market, but later exploratory work has indicated non-persistence in depth. A year ago the reserves included 54,000 tons of 38% copper ore, containing \$13 per ton in silver; also 30,000 tons of 58 to 60% copper ore. In the slide or talus another mass of ore is expected to yield 30,000 tons of 30% stuff, but this estimate, we are reliably informed, is much too high as to grade, which is nearer 10% copper. The costs of operation are high, the transport to Tacoma, where the ore is smelted, being \$16 per ton. Mining must cost \$10 to \$11 per ton. Loading facilities at the mine are poor. Although a wonderful mass of ore, it was exaggerated when first found and led the Guggenheims to spend a lot of money in building an expensive railroad, the Copper River & Northwestern, which, as yet, is unprofitable.

CANADA.—A new issue is announced, namely, the Aladdin Cobalt, a company capitalized for \$500,000 in \$5 shares. The property includes the Silver Queen claim, adjoining the Townsite and Right of Way mines. Up to 1908, the Silver Queen paid \$315,000 in dividends, and was then shut-down. Dealings in the shares have been started in London.

Our Toronto correspondent refers to the

strike of miners at the Cobalt Townsite. This has since been settled. The profit earned by this mine has been exceeding £3000 per week and the shares have attracted speculators.

CORNWALL.—The London, Australian & General Exploration Co., acting on the advice of Bewick, Moreing & Co., has underwritten £20,000 working capital for East Pool & Agar. A total of £40,000 is to be offered, and of this £12,000 is to be raised by the committee now in control of East Pool, so that only £8000 remains unsecured. The purpose is to develop the mine both east and west down to the 255-fm. level. The mine is well equipped with pumping machinery on the Agar shaft, and with a winding plant on the East Pool. On the other hand the mill, heretofore inadequate, is being increased now by the addition of two Holman air-cushion stamps, making 10 in all. Other improvements are contemplated. A new 10-drill compressor will be added to the one now in use, so as to push exploratory work. Particulars of the Rayfield (Cornwall) are given elsewhere in this issue.

VARIOUS.—An epidemic of fever has invalidated several members of the staff of the Frontino & Bolivia during recent months, hindering operations at that mine in South America. We are glad to learn that the fever has subsided and that no casualties ensued. This company is now doing better, the profit lately being at the rate of £2000 per month. Additional power has been provided, the shafts have been straightened, and exploratory work has been pushed, with fair results.

Among tin-mining enterprises, the Malayan Tin Dredging Company is interesting because of the application of a dredge, designed by F. W. Payne & Co., and capable of digging to a depth of 50 feet. An area of 700 acres has been tested by boring and is estimated to contain 1s. 6d. to 3s. per cubic yard, to be exploited at a cost of 4½d. per yard, when digging 80,000 cubic yards per month.

EDITORIAL

THE BALCOBO tin enterprise was criticized in these columns in June 1911. On October 22, 1912, an order for the compulsory winding up of the Balcobo Tin Mines, Limited, was issued in the Chancery Division.

IT IS SIGNIFICANT, and satisfactory, that the three competent engineers who have examined the Jemaa deposit are unanimous in appraising it as an unpromising prospect. Mr. C. H. Wray is confirmed by Messrs. J. F. Balfour and W. R. Rumbold.

THE VAUDEVILLE of Rhodesian mining gains in humour from the report on the Golden Kopje, in which the resources of certain claims are given in terms of "more or less probable ore." Mr. H. A. Piper endorses this report. Who will endorse Mr. Piper's report?

CONGLOMERATE is mentioned as the country-rock of a mine at Cobalt. This may cause the untechnical to suppose a resemblance to the 'banket' of the Rand. The conglomerate of the Huronian formation where penetrated by the silver-calcite veins of Cobalt is a rock so altered as to have lost much of its pebbly appearance and clastic texture. Only an expert geologist would recognize it as a conglomerate.

WE NOTE with pleasure that Mr. Scott Lings, when presiding over the Taquah Mining & Exploration Co.'s meeting, explained the meaning of 'working cost' and expressed the desire of the directors to avoid misapprehension by giving the net resultant profit, instead of the customary 'working profit,' which excludes so many essential expenses. The shareholders can take it from

us that complete frankness in such matters is one of the best guarantees of honest and efficient administration.

BORROWING analogy from the play at Drury Lane it may be said that the shareholder as Everybody hears the voice of Truth but does not see her, refuses to listen to that old hag Experience, and runs after the fat lady Greed. Meanwhile the Editor, as Nobody, makes sarcastic remarks.

IN our March issue we made note of the fact that the United States Circuit Court had rendered a decision that the Butters filter did not infringe the Moore patents. This case was appealed to the Appellate Court, which has now reversed the decision of the lower court. The latest decision sustains the Moore patents and grants an injunction against persons or companies guilty of infringement. This information comes by cablegram.

IN its issue of October 24 the *Financial News* published a column re-hashing Mr. Hoover's article on debentures in mining, appearing in our October issue. No acknowledgment was made as to the source of the article, and when we wrote to the editor of the *Financial News* suggesting that this omission was inadvertent, he replied saying that "due credit appears to have been given to Mr. Hoover, and we do not therefore see any ground for the complaint which you make." That being the case we make the fact known. Whether a discourtesy is obliterated by an impertinence is a nice question, but we can inform the editor of the *Financial News* that it is not usual to reproduce the substance of an article from another paper without acknowledgment of the periodical in which it was *first* published.

WE PUBLISH a timely description of the Premier Diamond mine and a valuable technical discussion of the best method of exploiting that remarkable gem deposit. The author, Mr. Ralph Stokes, was formerly our correspondent at Johannesburg, and is now in Canada. In connection with the terminology incidental to diamantiferous deposits, it is interesting to note that the rock containing the precious stone is called 'ground,' from 'blue ground,' the name first given at Kimberley. It is the raw pipe-filling, for the deposit fills a pipe or vent of volcanic origin. At the mine the word 'deposit' is used for the concentrate, containing the heavy constituents of the 'ground,' collected on the 'pulsators,' a kind of jig. It is a nice question whether the matrix of the diamond is 'ore.' We say No, because only metal-bearing rock is ore.

ACCORDING to a South African cable-gram, Mr. A. H. Ackermann is on his way to London, with a view to regularizing his position as resident mining engineer for the Chartered company. Complaints have been made that his private practice, assisted by his official position, encroaches upon that of unattached practitioners in Rhodesia. This in itself may seem unfair, but we deem it even more objectionable that an engineer in the employ of one of the share-dealing groups should be a provincial official and a private practitioner, all at the same time. It is probably the logic of events that has caused this conflict of interests, for we feel sure that Mr. Ackermann has as high a sense of rectitude in professional matters as anyone practising in Rhodesia.

EMINENT COUNSEL may err, for it is human to do so. Hence it is well to be slow in writing to *The Times*. The itch to write led to the pronouncement of an opinion that an individual director of a company has no right of access to its books or correspon-

dence for the purpose of informing himself, because the authority vested in directors is given to them as a unit and not individually. This statement naturally caused general perturbation; and more letters to *The Times*. The later letters, however, undid the harm of the first, by establishing the fact that the eminent counsel was wrong. We are now assured that "the directors of a company are the managing partners of the concern, and as such are entitled to the same rights of access to the books of the company as the members of an ordinary partnership." The decision quoted in the first letter referred only to the powers of directors as regards their relation to third parties. So all is well. Obviously the responsibilities of directors must not be lessened: they should be more fully realized.

WE SMILE at the accounts of a visit paid by Sir John French to the Frontenac mine, in Gilpin county, Colorado. The distinguished general was accompanied by Sir Charles Allen, whom the Denver newspapers call a 'peer,' and by Mr. Henry P. Lowe, the manager of the Frontenac Consolidated mining company. Here are all the elements for a mining vaudeville performance. The gallant soldier, deliciously ignorant of mining, the magnate whose little knowledge of metal mining is confused with his large experience in the iron trade, and the astute engineer-promoter, to whom the two Britons were as Sunday school teachers in a casino. The local press says that the Frontenac mill "has not been productive of desired results," so General French decided "to take a look at the property with his own eyes." We await his report with keen interest; rather, we say that having a great respect for one of the few military leaders who came out of the Boer war with a reputation, we hope he will not publish any report, realizing that his opinions may be interesting to his immediate friends but utterly devoid of value from the point of view of real

business. The Frontenac is a poor thing and we do not like the vaguely optimistic tone of the official reports. If the shareholders want a real inspection to be made, they had better engage an independent and unromantic mining engineer.

SPEAKING of names for financial companies devoted to the incubation and administration of mining enterprise, it appears that the Lake View & Oroya Exploration company is to be re-christened. The matter was mentioned at the general meeting. We can suggest a name: Adventurers Limited. In former days the shareholders in Cornish mines were called 'adventurers,' as persons making a reasonable venture in search for tin. The Hudson's Bay company to this day calls its shareholders "the adventurers trading in the Hudson's Bay territory." Adventure does not imply anything needlessly risky or inherently nefarious; quite the contrary, it bespeaks manly energy and intelligent enterprise along new paths. The word 'Limited,' while defining the liability, would also suggest reasonable restraint in assuming risks. The "new group" would thus have a picturesque and distinctive name without being confounded with venture-some corporations that finance on the edge of a razor.

THE ANNUAL MEETING of Stratton's Independence focuses attention again on the admirable management of that property, affording a gratifying contrast with the boom days, when everything was subordinated to market requirements. During the past financial year the output was worth \$758,977, bringing the total gross production of this famous mine to \$21,820,562. The mine did exceptionally well last year by reason of the yield of high-grade ore from the newly discovered Mill veins, which are now almost exhausted. In 1911 we published a description of the milling methods at Stratton's Independ-

ence from the pen of Mr. Philip Argall, the actual cost of milling confirming with exactitude the original estimate on a new method of ore treatment. The figures given by Mr. Argall covered only the last three months of the financial year ending June 30, 1911, during which months the mill for the first time attained a capacity of 10,000 tons per month. This capacity is easily maintained, but through stress of weather the mill was idle about one month last winter, which reduced the average tonnage treated to 9366 per month. Nevertheless the original estimate of \$1'52 based on milling 10,000 tons per month was not exceeded, as shown below:

	Estimate of 1907	First 3 months at full capacity	Year end ed June 30, 1912
Dump loading.....	\$0 10	\$0 08 91	\$0 09 5
Milling cost.....	1'24	1'23 90	1'271
Treating concentrate.....	0 18	0'172	0'137
Total cost.....	\$1'52	\$1'500	\$1'503

During the year 112,391 tons of ore was milled, assaying only \$3'10 per ton, for a profit of \$89,066. The extraction was as follows:

	1911 %	1912 %
In concentrate.....	43'65	42'19
In bullion.....	27'85	31'44
Total extraction.....	71'50	73'63

This record speaks for itself, but we are glad to add to it our hearty appreciation of the excellent technical and administrative work done by Mr. Argall. The old mine is nearly exhausted and it is but gleanings that are now being garnered, as compared with the prolific production of an earlier period, yet it is fair to say that the story of this British financial excursion into Colorado has been greatly redeemed in the last chapter.

The American Election.

Wishing well to the great Republic on the other side of the Atlantic, we are glad that Mr. Woodrow Wilson has been elected President. The continued monopoly of the vast patronage of the presidency by one party was a bad feature of American life. Since the

Civil War the Democrats have only twice elected a President, namely, in 1884 and 1892, and in both cases the same man, Grover Cleveland. This has tended increasingly to identify the Republican party with special privilege and industrial monopoly. A change was bound to come unless the United States fulfilled Kropotkin's prediction of "a democratic organization of capitalist rule." Fortunately, the change has been made in an orderly way, indicating the stability of American institutions and the ability of the people to correct abuses without disorder. Much of the credit for leading the people in a demand for clean politics and honest government is due to Mr. Theodore Roosevelt, who was the prime agent in awakening the thoughtful portion of the community to a realization of the corruption that was corroding the national life. He forged the ammunition that the Democrats fired at the party in power, headed by President Taft. He enlisted the sympathy and co-operation of men who usually stood apart from politics. He made it easy for a man of high character to consolidate the divided Democrats and to lead them through a victorious campaign. Indeed, the salient feature of American affairs at this moment is the fact that two men of high character have taken a hold on the imagination of a great nation. The days of *laissez faire* politicians, like McKinley and Taft, are gone. It will no longer serve for a President to be only honest and amiable, he must cease to be a tepid Laodicean, winking at men like Quay and Foraker, accepting the support of financial pirates, assuming the great responsibilities of the Presidency not as a trustee for the people but as the king-pin of a political machine. All that, we trust, is gone for good, having once been illumined by the fierce searchlight of the reform movement, not long ago ridiculed as sentimental foolishness. Instead the American people appears now, and, we hope, henceforth, to demand character in the men to whom it entrusts great

power. To Mr. Woodrow Wilson, a scholar and a gentleman, it has given an office too often the spoil of a political organization. To Mr. Theodore Roosevelt, the reformer on horseback, it has given the leadership of the Opposition, an opposition that should spur the party now in power toward reform and progress. Under such conditions no reaction is likely; we look for orderly advance and a steady amelioration of the political forces that exercise so potent an influence in moulding the industrial advancement of a continent.

A New Group.

We have read, with keen interest, the account of the Lake View & Oroya annual meeting. Not long ago we felt impelled to raise a smile at Mr. F. A. Govett's expense, on account of his speech as chairman of the Ivanhoe Corporation, but we are always as ready to applaud efficiency as to criticize errors. The time has come to forgive the buoyant egoism of the famous West Australian operator and to praise his skilful presentation of both facts and policy when addressing the shareholders of the Lake View & Oroya Exploration company. A speech that fills nearly five columns of a morning paper must be excellent to be worth reading from start to finish. Though not a shareholder in that, or any other, mining company, we did read the whole of it, finding it full of interesting features. The shareholders are to be congratulated on so frank and full a statement of their affairs. Obviously the tone of Mr. Govett's speech is one that commands the respect of experienced mining men, because it acknowledges blunders as freely as it expresses reasonable hopefulness. In mining, as in life generally, both qualities are necessary; the operator must learn to realize his mistakes, otherwise he fails to learn from them; he must also retain the sanguine temperament of the prospector, restrained by the caution of business as applied to speculation and of science as applied to industry.

However, the chief feature of the speech is the outlining of a new group. From Mr. Govett's acquaintance with Mr. H. C. Hoover, when both were playing a prominent part at Kalgoorlie, grew the combination that transferred the depleted Lake View Consols, Hannan's Star, Golden Links, and Oroya-Brownhill mines to three new companies, one of which, the Lake View & Oroya Exploration, acquired the general assets of the former Lake View Consols and Oroya - Brownhill companies. With the capital in hand and the revenue accruing, the Lake View & Oroya acquired sundry interests in other mines and undertook to act as a financial company, underwriting several issues successfully. Among its holdings are blocks of shares in the Leonesa mine in Nicaragua, the Kyshtim and the Orsk Goldfields in Siberia, the Fitzroy mine in Queensland, the Block 10, South Blocks, Zinc Corporation, and Amalgamated Zinc companies at Broken Hill, the Black Range, Mountain Queen, Transvaal, and Queen of the Hills mines in Western Australia, the Granville and Boyle's Concession in the Yukon. Some of these are sickly, some are promising, others are yielding handsome profits. The range of interest is great geographically, and bespeaks the wide experience of the controllers. They apparently know well that of mines it may be said, as of the saints, that many are called but few are chosen. Assuredly they have as much knowledge of mining, in its world-wide aspects, as any group in London. Besides Messrs. Govett and Hoover, there is Mr. A. Chester Beatty, one of the most forceful of the engineer-financier type of men now engaged in mining speculation. Like his friend Mr. Hoover, Mr. Beatty made a big reputation at an early age and has justified it at many a council-board since then. Mr. Beatty is not yet a director, but his purchase of a house in London indicates a proximate transfer of energy from New York. Among the directors of the company are Mr. Tyndale White, the chair-

man of Tanganyika Concessions, and Mr. W. F. Turner, the chairman of the Anglo-Continental, both gentlemen who must have learned a good deal from experience. Besides Mr. Hoover himself, the board includes another mining engineer of high standing, Mr. J. H. Corder-James. Thus the talent is ample for big work. We shall expect much from the company, which, as Mr. Govett frankly asserts, is to be "the corner stone of a powerful group." As yet "the relationship between the members of the group is somewhat indefinite and incoherent" and "its closer coherence simply depends upon success." When one or two of the lame ducks have been dropped and the several healthy ones metamorphosed to white swans, the new combination will be cemented, we doubt not. With it must come a change of name. Mr. Govett would be "sorry to see the disappearance of the old Kalgoorlie name 'Lake View.'" That is intelligible, but others will remember that the name of Lake View connotes not only a prolific production of gold but also a stupendous fiasco culminating in more than one tragedy. Even Oroya suggests an exhausted bonanza. Both names speak of Kalgoorlie, also a reminder of decadence. As an alternative something like 'Mines Debenture Corporation' has been mentioned, because capitalization by debentures has been adopted satisfactorily in the case of both the Kyshtim and the Granville. But even this name is inappropriate, for it will hardly continue to be distinctive. Something broader and more comprehensive is required. However, the christening may well be left to the official sponsors of the enterprise. Whatever its name, the organization will depend upon the personalities that give it life and activity: and of these we do not hesitate to say, whoever else may be conjoined later, that Messrs. Hoover and Beatty represent an amount of technical knowledge and financial astuteness not to be matched by any other two men now prominent in min-

ing affairs. We make only one suggestion: the public will play the game of mining speculation and allow the dealer a fair percentage, but they demand a run for their money. Some of the older groups occasionally appear to overlook this primary condition. It remains for the new combination to prove that money can be made not by fleecing the unwary but by accepting the public as a sleeping partner, though not in a literal sense. The day is gone for that. The making of money by clever financiers and experienced mine operators is not incompatible with a sense of responsibility to the small shareholders who in the aggregate find so much of the capital employed in mining. Without their support it will be a case of 'dog eat dog' among the big speculators; the groups will have 'to take in each other's washing'; the croupiers will have to play *petits chevaux*; the game will no longer be profitable.

Processes and Publicity.

The October meeting of the Institution of Mining and Metallurgy was marked by several interesting features. One of them was the fact that, at last, a paper dealing with the application of an oil-flotation process was read and discussed. Mr. J. W. Ashcroft described the concentration of copper ore at the Kyloe mine, in New South Wales, by what is usually known as the Minerals Separation or Sulman-Ballot process. The controllers of that process call it the 'agitation-froth' process, a name that cocks an eye at the Patent Office. However, there is less in a name than in a record, and we shall not quarrel with the sponsors of the process if they succeed, as seems likely, in training their godchild the way it should go, to mature success and beneficent age. It was fortunate for the author of the paper that it should have been introduced by Mr. H. L. Sulman, an acknowledged authority in this belligerent branch of metallurgy, but it was unfortunate for Mr. Ashcroft that the

same learned gentleman should have opened the discussion, because an expert speaking in London cannot help belittling the efforts of one less cognizant of the subtleties of such a delicate process when applied in the back blocks of Australia. However, that is a small point. The discussion developed a humorous aspect. Mr. Theodore Hoover, who is writing a book on methods of oil-flotation, attacked the Minerals Separation people for their persistent silence in regard to the technology of their process, while other gentlemen, who did not rise to speak, made sneering remarks about the advertising of the process by one of its leading exponents. Surely no criticisms could be so mutually contradictory. We regret silence on matters of technical interest, and we deprecate secrecy in such matters, because it entails loss not only to the profession in general but to the party of the first part also. The fresh air of publicity is as conducive to metallurgical progress as oxygen to roasting. It may be that litigation over patents, with its sequel of lawsuits over royalties, excuses our friends of the Minerals Separation. Assuredly it is only a slow-witted person that would sneer at a member like Mr. Sulman, who, at a late date it may be, but eventually, contributes a lucid exposition of the fundamental operations and follows this with details much to the point. To hint that such a valuable contribution to technology is in the nature of advertisement is both absurd and unfair. We wish the controllers of other processes would advertise them just in this way, by giving information useful to practitioners, instead merely of making claims for a 99% extraction at a theatrical cost. Mr. Sulman is entitled to cordial thanks for having prevailed upon his coadjutors to loosen the bonds of silence to an extent permitting him to contribute so important a share of the discussion.

Another lesson may be learned. We refer to the care taken by Mr. Ashcroft in recording the troubles and tribulations experienced in

the application of the process before his efforts were crowned with success. Undoubtedly the record of such an experience is helpful to others; we are apt to learn more from the failures than from the successes of other people, especially when they tell us how the failure led eventually to success. A man who never makes a mistake, never makes anything. The man who makes the same mistake twice is a damned fool. We rise on stepping stones of our metallurgical trials to the highest art of a complex process. If we had to choose between the record of difficulties encountered and overcome, on the one hand, and the story of instant success, on the other, we would choose the first, as being most likely to help our errant humanity. A weak man will avoid the recital of his mistakes; a strong man will state them frankly, so that his experience may aid his fellows. Such papers as the one by Mr. Ashcroft should be welcomed with open arms by our profession. If process-mongers will cease the effort to be mysterious and technical men will record their experiences frankly, we shall avoid a futile repetition of blunders.

Anglo-Continental.

With the publication of Mr. W. R. Rumbold's report, the Jemaa episode is complete. No criticism can be more useful than the bare recital of the facts.

The Anglo-Continental Mines Company was registered in December 1909, as a reconstruction from an earlier syndicate of similar name. Its operations were widely distributed, including West Africa, Mexico, Maikop, and Trinidad. In 1910 and 1911 the Anglo-Continental incubated several Nigerian tin-mining enterprises and acquired a share-holding in others, including the Bauchi, Naraguta Extended, Gurum River, and Gurum River Extended. The Anglo-Continental has a capital of £200,000 in 400,000 shares of 10s. each. Of these shares, 300,000 had been issued at the end of last year. From its subsidiary flo-

tations the company paid a dividend of 20% in January 1911, and one of 10% in February 1912. At the annual meeting on February 24 it was announced by the chairman, Mr. W. F. Turner, that an exclusive prospecting license, covering 12 square miles, had been obtained in the Jemaa district, where 600 acres of tin-bearing gravel had been proved. In the previous November, while prospecting along the ridges bordering the Jemaa river, with a view to finding the source of this alluvial tin, a large outcrop of tin ore had been found. "The outcrop proved in places to be very rich in concentrates," so said the chairman. This lode was 75 feet wide where it crossed the Jemaa river. Three prospecting shafts were started, and in one of them a rich orebody was uncovered. This assayed 25% tin, "pretty evenly distributed throughout the mass of the lode." Later information showed the width to be 30 feet for a length of 500 yards of ore assaying 24%, as ascertained by trenching. Mr. Turner spoke of these figures as being of "a very remarkable character" and expressed hesitation in giving them forth, in default of complete information. More work had to be done before "a sound judgment" could be reached concerning "the value of the lode as a working proposition," although the evidence sufficed to show that the Jemaa was "a property which should prove to be one of rare merit." However, he had just received a cablegram reporting a further discovery "on a new area," the lode being well defined, 30 feet wide, with an outcrop that had been traced for a distance of over a mile, carrying ore that was exceedingly rich. "This," he added, "brings up our length of outcrop to a total of 5 miles." After Mr. Edmund Davis had seconded the motion for a dividend, the shareholders listened to Mr. Oliver Wethered, not a director of the Anglo-Continental but the most prominent of the operators in Northern Nigeria, and honourably connected with Dolcoath. He made a comparison between the

1'97% yield of the celebrated Cornish mine and the 25% assay of the Jemaa, emphasizing the fact that, even, after discounting such a high percentage, the profit to be won from the Jemaa must be enormous, and also speedy, for the railway was practically completed. He urged the publication of interim reports. To this request the chairman replied that he and his co-directors saw no reason why they should not publish information from time to time, and they would be "very happy to do so."

On March 15, a circular was issued from the Anglo-Continental office, informing shareholders that the lode had been traced for "over 8 miles" and that "for a mile and a half the average width is stated to be 30 ft. and the average value 20% tin." On the same day, in the March issue of this magazine, the statements made at the meeting were severely criticized, it being claimed by us that the details as given did not warrant the expectation that the ore was persistent in depth. We asked why certain obvious questions were not sent by cable to the manager, Mr. John Thomson, with a view to obtaining definite answers in time for the meeting. Meanwhile speculation in the shares of the company had become excited, culminating in a price of £8 per share and in the formation of several bull accounts. Late on March 15 the market broke, the shares dropping to £5, but recovering to £6½. After that they steadied. No authoritative report was forthcoming. From the mine came more big talk. On April 12, the company issued another circular in which the manager, Mr. John Thomson, and the superintendent, Mr. E. C. Powis, were quoted as cabling that there was "a splendid body of ore, very rich. Judging from surface indications the lode has every appearance of being permanent in depth." The shares stood then at £6¼.

On April 20 a cablegram from an independent engineer, Mr. C. H. Wray, was published by the *Financial Times*. Mr. Wray

had been sent to Nigeria for a private syndicate, enterprising enough to ascertain the facts for themselves. He said that he had carefully examined "the alleged lode" and had found only "a belt of greisen in which occur occasionally very small patches of tin ore." In his opinion the prospect "was quite hopeless." Thereupon the shares fell to £4. But the company issued no information that met the necessities of the situation. A copy of Mr. Wray's report was furnished to them, only to elicit a petulant protest from Lord Harris, who, as chairman of the West African Mines, objected strenuously to "the supposition that anyone may go on to anybody else's property, examine it, and give the information he gets to the public." Meanwhile it was disclosed that an opinion by Mr. J. F. Balfour, acting for the West African Mines, a holder of Anglo-Continental shares, had been received in London on April 25 only to be made public on May 20, the text of the report appearing on June 5, on which date the shares fell to £1¾. Mr. Balfour reported a maximum width of 6 feet assaying as much as ½% tin, including occasional patches of 15% ore. Disconnected croppings had been traced for two miles. No tin-bearing alluvium had been uncovered, indicating that even the earlier reports of a wide extent of profitable gravel were fictitious. Mr. Balfour concluded by saying that he considered "the property as a prospect only." In the official circular containing this information, it was also stated that Mr. W. R. Rumbold had been engaged as consulting engineer, that the staff at the mine would be changed, that 10,000 shares at £5 had been issued since the annual meeting, that Mr. J. Schaar had resigned as a director and had been succeeded by Mr. E. W. Janson. Meanwhile the Nigerian Inspector of Mines, on April 9, had stated that for over a mile he had seen a series of trenches exposing "very rich visible cassiterite." Some of this must have been tourmaline, which is a constituent of the lode.

In June we published our conclusion that "the deposit consists of a big outcrop of micaceous schist, or schistose greisen, in which are scattered occasional patches or blebs of massive greisen, some of these being rich in cassiterite, while others are almost barren. At no time did the evidence warrant the confident assertion that a continuous lode of rich ore had been found." By that time the shares stood at £1⁵.

In July Mr. Rumbold went to Nigeria. On October 10 he cabled a report in which he quoted assays running up to 3'4%, *not* 34%, for as much as 28 inches, *not* feet. He considers the development work as satisfactory "in so far as regards definite results and valuable information," but he does not consider that "it has proved any profitable ore." He ends by stating that he expects to re-visit Jemaa about the end of the year and he hopes then to give "a definite opinion as to whether we [the company] are justified in spending more money on the lode." In short, we interpret this as meaning that he considers the alleged bonanza as a prospect so poor as to be almost hopeless. The shares fell to 17s. 6d., thus showing a difference of £2,500,000 in the valuation of the mine within seven months.

This is the story in outline. It remains to point to the fact that while the cablegrams about rich discoveries were received in November 1911, the first authoritative report by an expert was not published by the company until nearly a year had elapsed. Even Mr. Balfour's report, made in the interest of the Consolidated Gold Fields group, which was prominently mentioned in the share speculation, was withheld for a month. As to Mr. Rumbold's report, it may be stated that he had, unofficially, a pretty shrewd idea of the true position as early as March, and he, as an experienced tin-mining engineer, could have advised any client that the reports concerning the fabulous discovery were quite unreliable. He was engaged by the company in June, but

his report was made known in October. It could have been, and it should have been, made known in August. The story of the Anglo-Continental can be summarized as marked by reckless reports from Nigeria, unwarrantable optimism in London, unpardonable delay in obtaining accurate information, belated publication of that information when received, and between each of these factors is sandwiched a speculation in shares that ended, as such affairs usually do, in transferring money from the many to the few, and finally in blemishing an honourable industry. The moral is that the only opinion on a mine worth having is that of an experienced engineer of good repute, and the hour to have it is as promptly as time and place will permit.

Photo-chemical Effects.

Some time ago we published a short paragraph describing a process for softening water by passing a thin film of it over aluminium plates exposed to the full rays of the sun. The effect of this treatment is to cause the lime compounds to be precipitated in the steam-boiler in the form of soft sludge, instead of hard scale. The apparatus was called the 'luminator,' a punning creation based on the two chief agents. Much mystification has been prevalent throughout English-speaking countries as to the cause of this transformation of the hardness of water, and many engineers and chemists have gone so far as to brand the whole affair as an arrant fake, founding their argument on the fact that the aluminium plates do not lose weight. Other engineers, who enjoy the advantage of an acquaintance with foreign languages, were aware that the Continental scientists have shown the action to be due to light. The subject has been studied by Mr. Gaston Pasquier, who has applied the same principle to the precipitation of precious and other metals from solution. In addition, he mounts his aluminium plates at right angles to the magnetic meridian

presumably with the idea of putting them in series with the earth currents. The amount of information so far published by him is small, being confined to a short article in the *South African Mining Journal* for September 14, a précis of which appears on another page of this issue. It is possible that engineers and metallurgists may pass the article by, thinking that it is of no practical importance, so we take the opportunity of recommending them to study it, and to investigate the principles of photo-chemical effects.

Two reasons may be given for the shyness of the engineer to photo-chemistry, one being that apparently no energy is used and no material substance consumed, and second, either the time or the apparatus must be so great as to render the process useless. The collection of heat by the sun is open to such objections, whether the object be smelting or steam-raising, and we have already drawn attention in our pages to the futility of such propositions. By the way, a paragraph in this month's *Précis of Technology* contains particulars of the sun-power plant erected in Egypt. The chief industrial application of photo-chemistry is photography in its various branches. The reaction between hydrogen and chlorine is well known, and recently the same effect has been adduced as an explanation of certain results obtained in the manufacture of nitric acid by exploding coke-oven gases with air. On the Continent experiments are being conducted in the realm of organic chemistry where light-effects are multitudinous, the object being to reproduce the endo-energetic reactions induced by sunlight on the vegetal kingdom, and to intensify the actions in the plants themselves. On another occasion we shall revert to the application of photo-chemistry in the organic world, and show its bearing on the coal and oil industries. In the meantime we wish to reiterate our view that photo-chemistry affords an important field for research in connection with metallurgical operations.

Dredging in Frozen Ground.

In two preceding articles we have outlined the conditions governing the exploitation of alluvial deposits in the North, where the gravel is cemented by an enduring frost, and we have described the particular device invented to thaw the frozen ground. At first this 'steam-point,' as it is called, was used in drift mining only, but the application of it to softening placer ground for dredging was obvious. The obvious is rarely overlooked by the intelligent miner. Hence an early adaptation of the steam-point to operations in the valleys tributary to the Klondyke. Before artificial thawing is applied it is customary to remove the blanket of moss that covers the gravel. This is done in summer by ground-slucing, hydraulicking, or scraping. Then the steam-points are driven into the ground, and steam is admitted. By introducing steam into the frozen gravel, the ice is melted; the more water (as ice) there is in the gravel, the more steam will be consumed in converting water from the solid to the liquid state. Ice and rock are both poor conductors; and the difference in this regard is unimportant, the chief point being the heat absorbed in overcoming the latent cold. The pebbles retain the heat imparted to them and radiate it into the surrounding mass. The accompanying photograph shows a battery of steam-points at work on Bonanza creek. In the background are seen the boiler-house and the dredge itself, which digs progressively up the valley in the wake of the thawing. The steam-generating plant consists in this case of three boilers, fired with wood at \$8 per cord delivered, the steam-gauge registering a pressure of 150 pounds. By the time the steam reaches the spot where it escapes into the gravel the pressure has decreased to 25 pounds per square inch. In the foreground is the intricate system of piping, connecting the boilers with the steam-points. The main pipe-line is 3½ inches in diameter and is encased in a wooden conduit packed with sawdust as an

insulator. The pipes themselves are wrapped in asbestos packing. The branch pipes are of $1\frac{1}{2}$ inches diameter. At intervals of 8 feet a connection is made, by means of short lengths of armoured hose, with the heads of the steam-points. These consist essentially of 14 to 20-ft. lengths of $\frac{3}{4}$ to 1-inch steel pipe. In starting a 'point' it is customary to prepare a way by driving a $1\frac{1}{4}$ -inch steel bar, with an 8-pound sledge-hammer, into the ground until frozen

to rest for a while in the hope that the steam may prove effective, but if no progress can be made, it is inferred that an obstruction, such as a boulder, is in the way. Thereupon the steam-point is pulled out of the hole with the aid of a lifting-jack, and a solid steel bar is substituted. This is then hammered until it penetrates the obstruction or pushes it aside. If the incompetence of the steam-point is due to the clogging of the orifice through which the



THAWING WITH STEAM IN ADVANCE OF DREDGING FOR GOLD.

gravel is struck. Then the bar is withdrawn and the steam-point introduced in its place. The top of it is pounded by a man provided with a 4-pound hammer; concurrently a twist is imparted by a wrench held by a second man. This is done at intervals and in rotation as the ground becomes softened by the admission of steam. The rate of thaw is about two feet per hour. If the point refuses to sink, it is allowed

steam is emitted, this fact will be indicated by condensation at the head, as inferred by the chilling of the pipe and also by listening for a flow of steam through the hose. In this manner the ground is softened and made ready for dredging. The thawed gravel will remain warm for a month, but it is not advisable to apply the steam-points too far ahead of a dredge, lest the gravel should freeze again dur-

ing a wintry interval, nor is it economical to dig into the ground until the artificial heat has been fully expended. By this method the ground is thawed at a cost of 6 to 8 pence per cubic yard. The cost of overcoming the frost therefore is so high, in relation to the total expense of dredging, namely, 15 to 16 pence per cubic yard, as to incite an effort to evolve a cheaper method. To this we shall come in our next article, in which we shall describe the removal of the blanket of moss preparatory to natural thawing in summer.

Definitions.

No definition can be framed that will suit everybody, for everybody does not mean the same thing by a given term. Hence the need for defining technical terms, so that we may not mislead one another, even unintentionally. Thus an honoured correspondent writes objecting to our definition of ore as "metal-bearing rock that at a given time and place can be exploited profitably." He says that this definition is "highly dangerous." So it may be. The more accurate a gun, the more dangerous it is to use recklessly. We desire to prevent the reckless use of verbal instruments of precision, by giving them a definition that limits their range and fixes their aim. Our friendly critic asserts that the definition ignores "the factors of management, standing charges, and crushing capacity as compared with mine capacity." Well, are not these among the factors that determine whether metal-bearing rock *can be* exploited profitably? He quotes a mine that is operated at an excessive cost, because the management is defective, so that the ore fails to yield a profit. Of course, no definition will cover all the eccentricities of human nature. If a manager, for example, is so incapable as to squander money in his operations, he will, inevitably, turn 'ore' into 'waste,' by changing a profit otherwise assured into a deficit correspondingly certain. If, for example, the superinten-

dent of a mine mixes country-rock with his ore, in the effort to create tonnage, he degrades his 'ore' to 'waste.' But the definition contains the words "can be," which connote the idea not only of mill capacity and mine capacity, but of capacity on the part of the manager. No definition can include the imbecilities of a fool or the vagaries of a market operator, either of whom, the one by inadvertence and the other by purpose, may dilute ore into waste or increase expenses to the point of changing profit into loss. Our critic next quotes the case of a company that treats a dump assaying 3 dwt. per ton, although the total cost of operations is equal to 6 dwt. per ton. In this case the supply of ore in the mine is insufficient for the mill, and it has seemed advisable to crush the dump, on the assumption that half the total cost represents standing charges. Does our definition fail? No. When the rock in the dump was broken in the mine, and brought to the surface, it was found to contain so little gold as to be thrown aside. It was not 'ore' then. By the same token it should never have been hoisted or mined. If the manager had possessed an intelligent idea of what constitutes 'ore,' he would have left such unprofitable rock in its natural place. Instead, he squandered enough money on breaking, tramming, and hoisting this material as to represent half the total cost of operations. Obviously, if this expense be written off, then it may be profitable to send the dump to the mill. But it was not ore when first mined, and it only becomes 'ore' by a process of stultification. If Brown pays 12s. of the cost of mining, leaving Jones only 12s. more to pay, then rock containing 14s. per ton may yield the latter a profit of 2s. per ton. To Jones it is 'ore'; to Brown it is 'waste'; to Robinson it was waste that became 'ore' only because Brown squandered his money in meeting half the total cost. From an economic standpoint, the rock that contains 14s. worth of metal is

'waste' if, at the given time and place, the total cost is 24s. per ton. It *can not* be exploited profitably unless some fool is willing to contribute a large part of the necessary expenditure without gain to himself. That is what happened in the case quoted. Is it logical to expect a definition to cover such a performance? Moreover, it is obvious that once the cost of stoping, tramping, and hoisting had been met by this rock that went to the dump, it should have been milled, while in process of being handled, instead of allowing it to remain unproductive for a later period. This is on the supposition that the cost of milling has not decreased. By casting it aside at first and then moving it to the mill at a later period, the management incurred an added expense, for material once in transit is more cheaply moved than by breaking the sequence of operations. Again, the money spent in stoping, tramping, and hoisting remained in that dump, unproductive, until the later period when it was finally extracted, at the second bite, as it were. Again our critic says that while 3 dwt. stuff could not be included in the ore reserve, it might pay to treat a dump of such material in case the mine became unable to supply the mill to its full capacity. It depends. At the time when the 3 dwt. stuff was hoisted it would have been better to allow half the mill to remain idle than to lose 12s. per ton by mining such rock. At the later period it became advisable to treat the dump, only because somebody had made a present of the 12s. per ton expended in stoping, tramping, and hoisting. This cost may have been met at the expense of the former shareholders, now no longer proprietors. It may have been incurred when the mine was running on a different basis: with shares at £5 it might be depressing to earn only 2s. per ton, but with shares at 10s., even 2s. per ton might appear munificent. Here again the 'time' is changed, although the 'place' is the same. In California 12s. stuff may be ore;

in West Africa it is waste. The time and the place are factors; also the man. But in definitions we assume the man to be intelligent. It may seem an excessive assumption. Without it, however, we are without a *pied à terre*. Our critic, finally, says that the only definition for ore is "metal-bearing rock" without qualification. This is no definition. Every rock is metal-bearing. There is gold in seawater, and silver in the moonbeams. A definition that does not define is a fizzle. It is too much like Swift's definition of an archdeacon as "the man who performs archidiaconal functions." It leaves us where we were, only worse confounded.

Phantom Profits.

In our last issue we replied to a portion of the discussion published on this topic. We are glad to have Mr. W. R. Feldtmann's support in our campaign against illusions. He suggests that in most cases the concealment of fact is not intentional, but is the result of a competition in recognized items of cost. This is undoubtedly true, in large part, for some of the best-managed companies are culprits in respect of issuing statements of phantasmal profit. Also the custom obtaining among several large groups of companies whereby only certain recognized items of expenditure are included in the cost of mining did, as Mr. Feldtmann suggests, probably originate from a desire to make a record. The fact that many honourable managements have fallen into this way of fooling themselves and their shareholders renders it all the more urgent to unmask the practice and urge a return to realities. For instance, one of the companies with which Mr. Feldtmann is worthily connected, as consulting engineer, is the Ashanti Goldfields. Among the articles of agreement is one whereby the directors, who were the original owners of the property and the founders of the company, receive a bonus out of earnings. Last year this amounted to £10,345

equal to 3s. 5d. per ton on an output of 60,000 tons annually. There is no question whatever as to the propriety of this payment; it is simply in accord with a plain and perfectly understood contract. There is nothing sinister or suspicious in it. But we mention it, not without a friendly smile, as a good example of the difference between a profit and a cost. To the directors the £10,345 is profit; to the shareholders it is cost. It is a sum deducted from the money otherwise available for dividends; it is a legitimate part of the expense incurred in winning gold by the Ashanti Goldfields. This amusing anomaly can be emphasized without hesitation because the Ashanti Goldfields is a company that otherwise states its profit monthly with exemplary exactitude, deducting all the general expenses incurred in London, as well as at the mine.

We appreciate Mr. S. J. Speak's comment. He says that our articles are too "one-sided." This is inevitable, for we are trying to throw light on one aspect of a many-sided problem. We are glad that he should illuminate other aspects of it, as he does. More particularly do we appreciate his statement that engineers "should support any movement toward the enlightenment of shareholders." We believe that engineers do support such an effort, otherwise our own work would be futile. Of course, no shareholder can be protected against his own ignorance; but we hope to lessen his ignorance on mining affairs by suggesting to our friends, the engineers, how to dissolve that ignorance in the strong solution of experience. The ignorance of the public in these matters may be depressing to those who would wish to see it exhibiting reasonable sense in mining speculation, but that ignorance is no longer so abysmal as it was twenty years ago. The more intelligent the public becomes, the cleaner, straighter, and more efficient will be the administration of mining companies, and the greater the proportion of success. Naturally, the shareholders may be misled by new sys-

tems of account, as in the case quoted by Mr. Speak, but such bewilderment is not necessary if those at the helm will only take pains to explain. If these questions were more frequently ventilated and if they were better understood, then even the engineer whose costs are raised, owing to a radical change of policy and not through defective engineering, would not be saddled with blame wrongfully. The more light is thrown on the operations, the less likely is a capable man to be placed under a cloud. Finally, Mr. Speak makes a plea for the retention of the term 'operating cost,' insisting that without the use of it an engineer's estimate must involve expenses over which he has no control and on which he can obtain no reliable data, since they are essentially variable. The 'operating' figures, he suggests, are the engineer's own, but the 'total cost' is subject to the vagaries of finance—and of directors. This is partly true. It is well that the cost incurred in each successive operation at the mine and mill should be itemized, for purposes of comparison, whether with similar work at other periods at a given mine or to establish a measure of economy against neighbouring mines. But no engineer can appraise a mine as a means of making money unless he is cognizant of the top expenses to be added to the operating cost; and in order to give a proper opinion or estimate to a client he must make himself aware of the approximate ratio of expenditure to be incurred in administration, taxes, and other general expenses inevitable to the conduct of a mining company organized in London. No harm is done by separating operating cost from total cost, or working profit at the mine from net resultant profit to the shareholders; the harm is done by confusing them, by using such terms interchangeably, by self-deception that becomes the unwitting deception of others, and by the creation of a world of make-believe in which the shareholder wanders as in a dream, to be awakened by a fiasco, a scandal, or a liquidation.

SPECIAL CORRESPONDENCE

News from our own Correspondents at the principal mining centres

LIMA.

Alluvial Mining.—The Nueva California claims, extending over 41 square miles, in the province of Aymares, department of Apurimac, which cover alluvial ground varying from 7 to 15 cents (U.S.) per cubic yard for a depth from 30 to 150 ft., are being examined by D'Arcy Weatherbe. The properties are about 200 miles, by trail, from the coast (port of Lomas), at an altitude from 10,500 to 15,000 ft. above sea-level. They were repeatedly investigated from 1887 to 1892. The question of

Such property is unattractive to capital. The Sandia Mining Co., situated along the Machicamani and Capac-Mayo rivers, in the province of Sandia, department of Puno, is to be examined within a few months for English capital. In 1896 an attempt was made to drive a 1300 ft. tunnel through the ridge dividing the above mentioned rivers, and erect dams in order, as was stated, "to divert one river into the other, thus laying dry each bed in turn. This would allow the beds to be worked in the usual manner. The distance to be cleaned up in each



STEAMER "COYA" UNLOADING AT GUAQUI, ON LAKE TITICACA.

transport may prove to be a serious factor should operations be commenced on a scale commensurate with the apparent possibilities of the ground. The abundance of water is of considerable importance; a study of this question, made in 1890, indicated that an amount sufficient to wash 5000 cubic yards per day was available. The question of evaporation will probably require investigation. At present the natives do a little washing, in their crude way, during the rainy season.

There are other alluvial deposits in Peru that apparently warrant examination, but these either suffer from inaccessibility as regards the transport of material, or have not been sufficiently studied, so that definite data are lacking.

river would be some three to three and a half miles." The failure of the dams, once the tunnel was completed, resulted in the property being closed down. A little work was done and appeared to confirm the opinion that the river-bed carried enough gold to invite operations. The prospecting that is being done on the Santa river, not far from Chimbote, is said to be meeting with encouraging results, but details are lacking as regards the gold content.

In vein mining, the operations of the Andaray-Posco Company, at a locality two days by trail from Quilca, a small port north of Mollendo, appear to have reached a producing stage. Two Bryan mills, stated to have a capacity of 50 tons each per 24 hours, have

started crushing; the ore is said to carry about 0·9 oz. gold per ton, and 33,000 tons are "blocked out" in the mines. The Chuquitambo Gold Mines company, operating near Cerro de Pasco, seems to have had some difficulty with its new plant, due to the high consumption of cyanide as the result of the copper present. In the Potaz region, 6 days by train from Chimbote, some work has been started on the gold veins optioned to the Potaz-Parcoy syndicate.

Among the copper districts, Morococha appears to be the most prominent in the way of active development. The daily tonnage shipped, according to the figures of the Central Railroad of Peru, is from 500 to 600 tons of 8 to 15% copper ore averaging 10 to 40 oz. silver. The Natividad mine is still under water below the second level, and the new pumping plant (bronze-lined) and lead-lined discharge pipe are not expected to arrive until January or February next. Some ore is being mined in the old workings and sorted from former fillings and dumps. The Morococha Mining Company is planning extensive development work; the San Francisco mine is being opened up, and preparations to operate the San Miguel mine, by open-cut, are under way. The company has already started an adit that is to be about 4000 feet long before cutting the San Francisco veins, at a depth of about 400 ft. below the lowest working. The adit will serve more for drainage than extraction, and will afford facilities for prospecting in depth. The lowest level of the Natividad mine is about on the level of the cross-cut when it will reach the adjoining San Francisco mine. The cross-section is stated to be 6 ft. wide and 10 ft. high, and it is expected that 2 years may be required for driving the 4000 ft. It has been rumoured that a smelter-site has been selected at Paccachaca, on the Central Railroad of Peru, distant about 46 kilometres by rail although only some 15 km. by trail. At present the output of these mines goes to the Cerro de Pasco smelter.

The new furnace of the Backus & Johnston plant, at Casapalca, has not been blown in as yet: meanwhile surplus ores are accumulating above the present smelting capacity, so that the higher grade copper ore—above 12% copper—from the Morococha district is being shipped abroad. The new 180 ft. chimney is more than half-completed and is to be equipped with dust chambers. Experiments are being made by representatives of the Minerals Separation on the milling ore, also the tailing, as well as several dumps and other sources of ore in the vicinity.

The Cerro de Pasco smelter produced

3,600,000 pounds of copper in August. A recent preliminary study has been made as to the possibility of developing a central hydro-electric station near Oroya, the beginning of the Cerro de Pasco railroad, with a view to transmitting electricity to the Cerro de Pasco Co's mines and smelter, thus eliminating the use of coal for power purposes. It is probable that the Morococha Mining Company would also be served.

Work has been stopped on the Ferrobamba copper property, and other properties in the Chumbivilcas district nearer the railroad have been taken on option. The Sayapullo properties have been definitely optioned to a French syndicate, the consideration being £100,000 cash, and in addition £40,000 for the ore on the dump and 20% in stock of the 20,000,000 franc company to be formed. The engineers of the syndicate are expected to examine the properties shortly. The properties of the Peruvian Mining, Smelting, & Refining Co. (namely, the 300-ton smelter at Rio Blanco and the Churruca mine at Morococha), which company was formed during the copper boom of 1906, are to be put up for auction. The company failed in having no mines of sufficient tonnage to make operations independent of outside ores, as well as the inability to develop a custom business. At one time, in 1909, the opportunity of obtaining control of the Backus & Johnston holdings was possible, but the negotiations fell through. The Gasurra Mining Co., in the province of Cajatambo, which in previous years exploited rich silver ore and later treated the low-grade ore by lixiviation, has been optioned, on a share basis, to the Anglo-French Ticapampa Co. The latter company has been operating successfully for almost 40 years near Recuay, shipping high-grade lead-silver ore and lixiviating low-grade products.

KALGOORLIE

Tin.—Although never mentioned in any of the government bulletins, the Poonah-Coodardy tin district, in spite of the dilatoriness of officialdom, looks like pushing its way to the front. This district, situated about 43 miles west of Cue, extends from Cuddingwarra to Mindoolah. It was discovered in 1909 by Paton and Roddy, but, owing to absence of water, little has been heard of it. At the beginning of this year a Fremantle syndicate, represented by F. C. Gill, took up a lease, and located two parallel tin-bearing lodes about a quarter of a mile apart. G. V. S. Dunn, of Melbourne, was called in, and gave a favourable report in May, and the Government was

asked to arrange for a water-supply. After a long delay Harry P. Woodward, the Government Geologist, was sent to report. Mr. Woodward has just completed his inspection, and his verdict is said to be favourable. In the meantime, however, Thomson & Coates, from their lease at Coodardy, consigned a parcel of 25 tons to the Great Fingall battery at Cue, and this lot has panned out 4% black tin per ton. At present black tin is quoted £130 per ton, or 26s. per unit, so that this parcel is worth 104s. per ton, or £130 for the 25 tons. Gerald Shaw, who was in charge, says the ore was broken haphazard right across a 15 ft. 6 in. lode near the surface. On the adjoining Atkinson block Mr. Shaw declares that there is a 30 ft. lode of even higher grade; and samples, which have just reached Cue, seem to confirm this view. Since September 1911, a prospector, E. Winnett, has been accumulating wash-dirt at the rate of 15 to 20 tons monthly, and has a dump estimated at 200 tons going 1 lb. of tin per dish. This is equivalent, at present prices, to about £10 to £11 per ton. Of course, Mr. Woodward has seen all that is to be seen, and, until his report is published, it is too early to predict how the field will pan out. As Bewick, Moreing & Co. have recently been searching for tin properties in the Pilbara district, it is certain that they will not neglect a field so close to the Great Fingall mine.

Southern Cross.—The Holman air-cushion 2-stamp mill has now been running eight months on the Mountain Queen mine near Southern Cross and has treated 31,801 tons for £27,777, or 17s. 5½d. per ton by amalgamation. Total costs, exclusive of development, have been about 10s., of which mining and milling took about 4s. 5d. each, and general expenses the remainder, 1s. 2d. With 123 drops per minute the mill consumes 34 h.p., and crushes 150 tons in 24 hours. When speeded to 135 drops, the horse-power rises to 45, and the out-put to 200 tons. The total cost of the plant, erected and housed ready for work, was £3800. The wear and tear on shoes has been 0.248 lb., and on dies 0.199 lb. per ton of ore crushed. The diameter of shoes is 12½ in., and weight 224 lb., and of dies 14 in. and 177 lb. The result is regarded as so satisfactory that a similar plant is to be installed on the Queen of the Hills mine at Meekatharra, now owned by the Oroya Exploration Co. In this mine 86,300 tons of ore assaying 45s. 6d. is assured. Both mines are to be equipped with a vacuum filter-press, and an extraction of 90% is anticipated. The filter

plant on the Mountain Queen is practically complete, and in future the extraction is expected to be 26s. per ton, and the output 4500 tons monthly, as Sunday running is allowed by law in a continuous process. There is still some doubt regarding the sulphide zone in the Mountain Queen, for developments are rather backward, but are now being pushed ahead.

Meekatharra.—After wasting £100,000 on the Taquah Central in West Africa, the Great Fingall has taken an option on the Marmont at Meekatharra. This mine has been operated by working miners since 1904, and has been equipped with a 10-stamp mill and cyanide plant entirely out of proceeds of gold won. Up to the end of August, 41,552 tons had been treated for a return of £135,000, and £41,043 paid in dividends. For a long time past 600 tons had been milled monthly for a yield of £1700. North of the Marmont, and working the same lode, is the Fenian, which has produced £315,134 from 55,200 tons, and paid £137,665 in dividends. Recent monthly returns show £8,000 from 2600 tons and £4000 profit. Thomas Ryan, the chief owner of the Marmont, is also chief owner of the Fenian. He started both mines in 1904 with practically nothing but his brain and muscle and common-sense. The next mine to the Fenian is the Ingliston Consols Extended, owned by the Roberts brothers, who also started with next to nothing. This mine is equipped with a 10-stamp mill and cyanide plant, and has produced £146,276 from 48,441 tons, and cleared about £50,000 profit. Its monthly crushings are now £3000 from 1500 tons, with £1300 profits. The Queen of the Hills is on a parallel lode to the west.

Binti-Binti.—A good deal of attention is being drawn to Binti-Binti, a district about 50 miles northeast of Kalgoorlie, owing to Thomas Creer, the representative of the Kurnalpi Option Syndicate of Adelaide, going there after condemning Kurnalpi. This district has been known for several years, but, as there is no water-supply, and the nearest mill is at Gindalbie, 20 miles distant, it has been quite neglected. On the Havilah one shaft 100 ft., another 80 ft., and several potholes have proved a lode for 450 ft. in length, 24 in. wide, and worth about 70s. per ton. A picked crushing of 205 tons was treated for a return of 231 oz., or £980, by amalgamation. Costs included carting, 35s.; crushing, 15s.; and loss in residues, 40s. per ton. This was, of course, a picked parcel, but, as the prospectors barely got a living out of it, they, naturally, sent no

more ore to the mill. The Mining Inspector was favourably impressed with the locality, but the Government refused to erect a battery on the spot, or to sink a well, although they put down a borehole, which struck fresh water at 106 ft., until there was a sufficient population to warrant the outlay. Two men have stuck to the Havilah for over three years, although for months at a time they saw no one except when a tradesman's cart arrived with supplies.

TORONTO.

Porcupine.—A marked revival of interest in this district has been caused by the placing of the Hollinger mine on a dividend basis. The first payment will be made on November 2 at the rate of 3%, and a similar dividend will be paid every four weeks, making the yearly returns to shareholders 39%. There has been some difficulty in marketing the gold produced, consignments sent to the Ottawa and New York mints being returned because it was not sufficiently pure for coinage purposes, and at present it is being sold to reduction companies. Shipments to date amount to \$464,000. The Dome is awaiting a supply of electric power from the plant at Waiwaitan Falls, where 12,000 hp. is being developed. The transmission line to the mine is almost completed, and it is expected that the electric current will be turned on by November 1. Another tube-mill and slime-press is being added to the mill equipment, which will raise the total capacity to 450 tons per day. The inclined tramway from the ore-house has been continued down to the 100-ft. level. It is estimated that the 60-ft. and 100-ft. levels will furnish a supply of ore for ten years for a mill of the present capacity. The mill at the McIntyre will be a cyanide plant consisting of two units, the first of which, of 150 tons capacity, it is hoped to put in operation early in January. Rolls, Chilean mills, and tubes will be used. The present mill will treat the ore from the upper levels, and that from the lower levels, tributary to No. 4 shaft, not being suitable for amalgamation, will be reserved for the new mill. The McEnaney will shortly have 5 stamps ready for operation, leaving the other five to be added in the spring. A large orebody is said to have been blocked out. It is estimated that the ore assured is worth about \$750,000, and that ore to the value of about \$100,000 is on the dump. The orebody recently cut in the Pearl Lake mine, in cross-cutting on the 400-ft. level, is 18 ft. wide, and gives assays of \$30 per ton

across the entire width. As this find confirms the result of diamond-drilling on this level, it appears to give good ground for the expectation that the discoveries made by the diamond-drill at 800 ft. will prove equally promising. The Dome Lake is in good ore at the 180-ft. level. Excellent progress is being made in preparation for the erection of the 10-stamp mill. The dispute over the affairs of the Crown Chartered has been settled by a re-organization, and the election of a new board of directors. O. L. Henault and J. P. Heffernan have accepted stock at 25 c. per share in settlement of their claim of \$140,000 against the company. The Hughes has ordered a 2-stamp mill for the purpose of testing the ore until a larger mill can be built. The Vipond is preparing to put in a cyanide plant, the amalgamation process being unsuited to its ores. At the Dome Extension some good discoveries have been made on the 200-ft. level, where a large orebody is being blocked out. The Hollinger Reserve has ordered a 5-stamp mill and is sinking to the 200-ft. level. The veins show improvement with depth. The Moneta, which has been working under difficulties caused by flooding, has been closed down. Underground work at the Swastika has been suspended until the mill is ready. The Lucky Cross in the Swastika district is preparing to install 5 stamps with accommodation in the mill for five more to be added later. The discovery of a rich body of gold-bearing quartz on an island in Night Hawk lake lying east of Porcupine has caused a rush of prospectors to that district and a large number of claims have been staked.

Cobalt.—The total production of silver from the Cobalt district since 1904 up to June 30 of this year was 140,230,383 oz., valued at \$72,263,952. The output for the first six months of this year was 14,258,403 oz., worth \$7,936,602. The total dividends amount to \$35,242,318. At the property of the Seneca Superior Co., worked under lease from the Peterson Lake, a highly important find has been made. In cross-cutting beneath Cart lake at the 200-ft. level a vein 3 in. wide has been encountered in the conglomerate running 4000 oz. silver per ton. This vein is quite distinct from the known vein system of the locality. As it is the first high-grade ore found in the conglomerate in the vicinity of Cart and Peterson lakes, the strike has stimulated activity on the adjoining properties. The Beaver will increase the capacity of its mill from 60 to 120 tons per day to enable it to treat the large amount of milling ore extracted

from the lower levels. The main vein at the 600-ft. level is 5 in. wide of 2000 oz. ore. The Donaldson property in the Elk Lake district, now owned by the Beaver, is undergoing active development. A new shaft is being put down and a power-house is being built. The Crown Reserve has recently made some good discoveries, including a branch of the Office vein, struck in cross-cutting on the 200-ft. level. Another kind of 'strike' occurred on the 19th inst. at the Cobalt Townsite, when over 100 men went out on being refused a reduction of the working period from 10 to 9 hours per day. The 9-hour system prevails at other mines in the vicinity. The Rochester has been re-organized with a reduction of the capitalization from \$2,500,000 to \$1,000,000. The old shares are called in and new shares given in their place in the proportion of one new share to four old ones. A block of the

on the Silver Ruby property. The Penn-Canadian has shipped its first car of concentrate. A company named the New York-Ontario Silver Mines has been organized by Americans, capitalized at \$1,000,000, to operate the King Edward. The La Rose has issued a statement for the first eight months of the year showing the gross value of the output at \$1,101,849, and the net profit at \$600,475. The cash in hand and value of ore in transit and at smelters was \$1,735,505. The absence of further discoveries and the uncertainty as to the policy of the directors in regard to the disposition to be made of the large cash balance combine to keep the stock at a low level.

South Lorrain.—During the quarter ending September 30 the Wettlaufer produced 195,273 oz. silver, on which the net profit was \$77,396. The consulting engineer, Fred.



THE DOME MINES, PORCUPINE.

new stock will be sold to raise funds for development. The Preston East Dome, which has acquired the Silver Bar, has encountered a strong vein of calcite, niccolite, and smaltite on the 50-ft. level. The silver content is inconsiderable, but the vein will be followed in the hope of enrichment. The Kerr Lake has declared its regular dividend of 25 c. per share, but the accompanying report is not encouraging. It shows net profits for the year ending August 31 of \$769,175, as compared with \$937,379 for the previous year, and an output of 1,885,495 oz., as against 2,388,420 oz. The Lost and Found Co., which is developing several old-time prospects that had been regarded as hopeless, has opened up the Red Rock, the Agaunico, and the Cobalt Contact, and is erecting a small reduction plant

Hellmann, reports that as the production of silver for the nine months ending September amounted to 658,647 oz., the silver remaining assured only amounted to 341,300 oz., and that without further discoveries dividends could not be much longer maintained. The Kissinger is installing a plant and has a shaft down 100 ft. Work will be undertaken at that level to pick up the vein that dipped out of the shaft at 50 ft.

Gowganda.—A controlling interest in the Bruce claims on the Mann ridge, where a vein showing native silver has been uncovered, has been bought by a Buffalo syndicate. The concentrating plant of the Milleret has been closed down owing to the exhaustion of the present supply of low-grade ore. The Powerful has five veins running parallel at the 200-

ft. level and showing good silver content. The Bartlett property has been taken over by the Scottish Nigeria at a price reported at \$150,000.

CAMBORNE.

East Pool & Agar United.—This cost-book company is to adopt limited liability in the near future, and Bewick, Moreing & Co., who are interesting themselves heavily in Cornish mines, are providing fresh capital to adequately develop and equip the properties. For years past, I have repeatedly drawn attention in these columns to the inadequate development of these famous mines, which has been largely due to the fact that the management has had to make both ends meet, owing to the shareholders not being disposed to pay calls, a short-sighted policy, seeing that without proper exploration few mines can hope to succeed. There is no reason to doubt that by the expenditure of a few thousands underground, proper centralization of the surface plant, and the provision of their own arsenic refinery, East Pool and Agar will once more become a profitable investment.

The Cornish Exploration Company, with a capital of £20,000, is another enterprise which has recently been registered to devote attention to the mineral potentialities of Cornwall. The subscribers are all substantial people, or represent strong financial groups, and the company will conduct the investigation of the various propositions at present under offer to one or other of these groups and arrange the preliminary financing of such schemes as may be favourably regarded.

Rayfield (Cornwall) Tin Syndicate.—This syndicate, with a capital of £75,000, has been formed by the group controlling the Rayfield (Nigeria) Company to prospect and finance mines in Cornwall. The statutory meeting of the company has been already held and was a more interesting affair than such meetings usually are, by reason of the fact that Oliver Wethered, the chairman, gave a full description of the syndicate's various interests in the county. A half-share has been secured in the Gwithian sand undertaking, referred to elsewhere in this letter, the Basset & Grylls mine at Wendron, and the Zennor sett near Geevor in the St. Just district, have been acquired; substantial interests have been taken in the Dolcoath and Geevor mines, a joint option with the Rayfield (Nigeria) Company has been taken on North Dolcoath, referred to in my notes of last month, and on another property near St. Just, and finally the syndicate

has agreed to provide part of the capital to reopen Killifreth. There can be no question that, taken as a whole, the interests acquired are an excellent selection. Being one of the first in the field, the syndicate has been able to secure some of the most promising properties, and the shareholders certainly deserve to be rewarded for showing their confidence in Cornwall as a mining district.

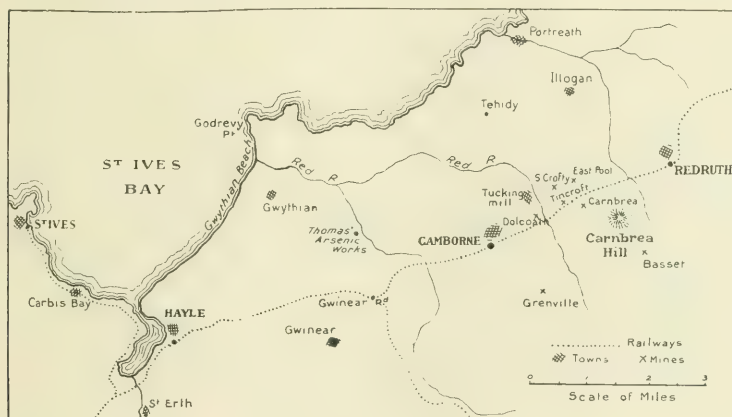
The Basset & Grylls property is already equipped with pumping, winding, and dressing plant, and it is stated that the mill will shortly be re-started. There are several lodes on the property, some of which have been tested down to the 35-fm. level, and although they are narrow, they are often rich. The old company had to suspend operations through lack of capital, after bringing the concern to the producing stage. While the mill was running, close on 4000 tons of ore was treated, the average recovery being 24 lb. per ton.

Gwithian Sand.—This sand, mentioned briefly in my notes last month, has been tested and reported on by G. C. Lush and R. C. Nicolaus, the latter on behalf of Percy Tarbutt & Co. Mr. Nicolaus states that in all 841 samples were taken from 447 pipe bore-holes, 155 pits and 37 drill-holes, so that the sand has been extensively tested. He estimates that the average thickness is 36 inches, and that there is 1,208,725 tons containing an average of 6.45 lb. metallic tin to the ton. Of this quantity, 594,905 tons represent portions of the beach below high-water mark, of a value of 4.13 lb. per ton; the balance he divides as to 393,530 tons having an assay-value of 19s. 9d. per ton, at a price of £229 for metallic tin, and 220,290 tons at 15s. per ton, on the same basis. A further 82,392 tons has now been proved having an assay-value of 20s. 5d. per ton, so that above high-water mark there is estimated in all to be 696,212 tons of an average assay-value of 18s. 3d. per ton or £637,267. From these figures it would appear that the average assay is about 9 lb. per ton. With metallic tin at £150, or say 1s. 4d. per lb., which is a safer figure to adopt, and assuming a recovery of 66%, this stuff is worth 8s. per ton, or £278,484. Seeing Mr. Nicolaus estimates that the working cost should not exceed 4s. per ton, on this basis, a total profit of over £139,000 is shown, so that provided the concern is not over-loaded with paper capital, the return should be a very fair one. The chances of the price of tin remaining above £150 per ton are excellent. It must be remembered also that large quantities of sand and slime continue to pass

daily down the Red river, although what proportion of the tin in this sand and slime can be profitably extracted has yet to be proved.

The St. Agnes District is deservedly receiving a share of attention now that there is a demand for promising shallow mines or virgin properties. The lodes are usually narrow but often rich. Many a fortune has been made from the mines surrounding the St. Agnes Beacon, although probably none of them are more than 1000 ft. deep, and many much less. A large area, including the famous Royal Polberro, Blue Hills, and Polbreen mines, is held by the St. Agnes Consolidated Mines Limited, but are not being worked, although East Blue Hills, another shallow proposition, has been operated for some time past by that company

any stoping of consequence can be done. Unfortunately the present company has exhausted its capital, and this important and promising piece of development work remains untouched. This lode enters the adjoining sett of Wheal Kitty & Penhalls and should be intersected by that company's main shaft at a depth of about 900 ft. The latter company, after having gone through a rather lean twelve months, has again improved its return, which is now 14 tons of black tin per four weeks, from an output of 1150 tons of ore, which means a recovery averaging 28 lb. per ton. The vigorous development policy of this company has borne good fruit, for according to the latest monthly report several of the ends are now in profitable ore; should the new points continue in



with excellent results. The principal mines now in operation are West Kitty, Wheal Kitty & Penhalls, and Wheal Coates. At West Kitty, the tonnage handled in the mill is about 400 per month, part of which, however, comes from East Blue Hills, and as, according to the ticketing, the return is approximately 15 tons, the average recovery from the two mines is about 21 lb. per ton. In the Wheal Friendly section of this mine, a first-class lode was intersected some months since, averaging 5 ft. wide and over 60 lb. per ton, and this has been opened up both east and west for some 30 fm.; for practically the whole distance, the lode has maintained the average stated. The lode, however, is cut off in the back by a slide, and it is necessary that the shaft should be sunk another 20 fm. before

good ore, monthly sales of 16 tons will speedily be maintained, and the pressing question before the management will then be a new mill. At present the mill consists of 48 Cornish stamps, which will deal with about 1400 tons per four weeks, while a feature of the practice here is that the feed from the stamps goes direct to buddles. The sinking of Sara's shaft, which is in the centre of the property, has now been suspended at a depth of 750 ft. from surface; in the drift east on the Wheal Kitty lode, at the 730-ft. level, the lode is 2 ft. wide and worth 28 lb. per ton, while in the western end, at the same depth, the lode has been cut off by a cross-course. At Wheal Coates, the permanent pumping plant has been installed and the water lowered to the 40-ft. level under adit. The erection of the

Californian mill has also made good progress, and at no distant date returns should commence, because a large amount of lode which will average about 28 lb. per ton, has been proved to be standing in the old mine.

At South Wheal Leisure, near Perranporth, active development is to be commenced shortly. This is a virgin property, on which a prospector has sunk a small shaft on the lode for a depth of about 100 ft. The lode varied considerably in width and value, in places being 4 ft. wide, and the leader assaying as high as 30%. From the shaft alone $4\frac{1}{2}$ tons of black tin has been sold, so that this prospect is evidently worthy of the serious development which is now to be undertaken. Another venture, to develop which a company is now in process of formation, is the Droskyn & Wheal Ramoth mines at Perranporth. The workings on these properties are very ancient, the best ground down to a few fathoms below the water-level having been extracted long before the introduction of steam pumps. The remains of the old water-wheels, which worked the primitive pumps, can still be seen in the underground chambers, accessible from the cliffs. Locally, opinion is much in favour of this venture, and a considerable portion of the capital is being provided in the district.

SAN FRANCISCO.

Mexico.—Mining conditions throughout the state of Chihuahua have generally improved during September, according to the Chihuahua *Enterprise*, both because of the dispersal of the rebel forces from the larger settlements and the subsequent re-establishment of railroad traffic on the National and Mexican-Northwestern lines into Chihuahua. At places in the western part of the state and remote from railroads, however, operations have been harassed by bands of rebels, who have compelled the cessation of work at some of the larger mines, such as the Dolores, Concheño, and Yoquivo. At these, as at other mines, advantage is being taken of the enforced situation to make a general overhauling of mine and mill machinery, with the expectation of running at full capacity within a month or so, by which time it is anticipated that the roving rebel bands will have moved into other states to the south. The main losses, other than such as are attendant on the forced suspension of operations, have been in stores and fire-arms, sufficient care having been taken in most cases to send out or conceal all bullion before the appearance of the marauders. In several instances, however, money was paid

over to the chiefs. Foreign companies, which are the main operators, suffered most from these predatory bands.

The Chihuahua plant of the American Smelting & Refining Co. has operated uninterruptedly, as an abundance of ore was obtainable locally and the supply of coke and coal ample. The Rio Tinto smelter, at Terrazas, however, was forced to suspend for about 40 days, on account of fuel shortage, but it is again at work. Operations must be hampered for some time on account of uncertain railroad traffic, resulting from the wanton destruction of track and bridges by retreating rebels, and by subsequent heavy rains. The National line is open to Torreón and Parral, but it will require at least a month for establishment of service between Chihuahua and El Paso. The Mexico-Northwestern railway is operating irregularly from Chihuahua to El Paso by way of Madera. Owing to the temporary repairs and the generally bad condition of the roadbeds, traffic is rather slow and the movement of heavy trains is impracticable at present.

Activity at Parral and Santa Barbara is confined to a half-dozen of the larger producers, such as Minas Tecolotes, El Rayo, Alvarado, Moctezuma, and San Francisco del Oro. Work has been resumed at the Inde and Guadalupe mines, at Inde, in Durango, but little activity is reported from Guanacevi. Cusi-huiriachic has been remarkably free from trouble, except the impossibility of shipping its ores on account of lack of railroad facilities, and development continues uninterruptedly.

A few investors, particularly Englishmen, are taking advantage of the present lower prices asked for good properties, and it is likely that a number of transfers will soon be recorded. Donald B. Gillies and associates are reported to have acquired several productive mines controlled by the Terrazas-Creel interests. Work has already been started on one, the Magistral, about 25 miles west of Chihuahua. Mexicans in particular are offering properties at greatly reduced prices.

An important Federal ruling is to the effect that mining taxes paid to the revolutionists during their control of Chihuahua affairs need not be paid a second time to the Federal authorities. The final limit of payment was extended to October 1. Prior to this ruling there was considerable anxiety among mine owners, who feared that the payment of these annual taxes to the rebels might be no bar to a demand for their second payment to the constitutional government.

Oil.—Increased activity in the development

of the California oilfields is shown by the announcement that has come from New York of the organization of the California Petroleum Corporation, with an authorized capital of \$35,000,000. This company has taken over 80% of the stock of the American Petroleum Co., and the same amount of the American Oilfields of California. These are generally known as the Canfield-Doheny properties, and include the Niles Lease Co. and the Midlands Oilfields of California. Ralph Arnold has reported on the properties and states that they include in all over 18,816 acres, situated in the Coalinga, Midway, and McKittrick fields, of which 3786 acres has been proved. There are 110 producing wells, of which the present

oil is an interesting one. It will be remembered that a comparatively few years ago there was practically no market for gasoline; the kerosene refiners allowed as much of the light products to remain in illuminating oil as state and municipal regulations would permit, and were then at their wit's end to dispose of the remainder. The meteoric development of the motor-car and the devising of other uses have changed all that, and the problem now is to secure light products, rather than heavy oils. The Royal Dutch and Shell companies have, therefore, obtained a foothold on the Pacific seaboard, since their oil is much lighter in character than the heavy asphalt-base California oil. The development of engines able



THE PORT OF VERA CRUZ The scene at a recent visit.

output is approximately 500,000 bbl. per month. This will make the sixth large producing company in the California fields. The Standard, Associated, Union, and Independent Producers' Agency have been established for several years, while the fifth, the General Petroleum Co., is making rapid strides in the construction of extensive surface equipment that will make it a factor to be reckoned with in the competition of trade. Shares of California Petroleum are active in New York and are stimulated by the repeated, and as often denied, report that eventually Mexican Petroleum will be merged with it. As the latter is a steady dividend payer, the inference is that California shares can be expected to rise. The campaign to distribute the shares to the New York public is apparently attaining success.

The general situation in regard to California

to utilize heavier oils than gasoline promises to relieve the situation somewhat, but there is no doubt that an important field for California oil producers to cultivate is the market for the heavier grade of oils. It is reported that the price of oil at the well will shortly be increased to 40 c. The present stock of heavy oil held by the Standard Oil Co. is so large and is moving so slowly that it has announced that until further notice it will purchase no more, as it has from 25,000,000 to 30,000,000 bbl. in stock. The price of 35 c. per barrel at the well is certainly not one which offers much opportunity for profit to the average producer. On the other hand no one can deny that there has been enormous waste and extravagance in the development of the California fields. Some of this is unavoidable perhaps; the early history of every mineral district is marked by

a tendency of the first comers to skim off the cream of production, even at the cost of producing quantities of skim-milk for which no use can be found. Nevertheless the crudity of the apparatus now employed in oil production and the waste in the methods used for the generation, transmission, and application of power is almost pitiable. Low-pressure steam is generated in central boiler plants and sent through buried line pipes, often over 1000 ft., to operate slide-valve engines. Power for drilling and pumping is applied by home-made 'bull-wheels' and 'pump-jacks,' and the hoisting-drums for tools and boilers are often made of wood and fitted on shafts made of pieces of gas-pipe rotating in journals gouged out of wooden blocks. Occasionally these are greased. Not more than 10% of the boiler energy is usefully applied. Producers charge themselves nothing for the oil they consume in power generation. It is interesting in this connection to quote the following figures, which the *California Oil World* thinks represent the average cost of production and marketing of California Oil:

	Per bbl.
Average first cost.....	\$0'40
Storage and transportation.....	0'15
Interest and taxes.....	0'08
Evaporation and seepage.....	0'07
	—
	\$0'70

On this basis even a price of 40 c. per barrel at the well therefore only represents meeting the cost of production for the average producer.

The Midway Gas Company of California, is at present constructing a plant for piping natural gas from the Midway fields to Los Angeles for domestic purposes, while two companies, the Purity Gasoline Co. of Santa Maria, and the Pacific Gasoline Co. of Brea, are producing a good grade of gasoline from natural gas by means of air-compressors and condensers for after-cooling. It is stated that the natural gas produced by the Rice Ranch Oil Co. furnishes approximately $2\frac{1}{2}$ gal. of gasoline per 1000 cubic feet of natural gas, the total output of gas from the wells being approximately 2,000,000 cubic feet daily. While all natural gas is not suitable for the production of gasoline, there is no doubt that there is a promising opportunity for profit by investigating and developing this method of producing gasoline. The enormous demand at present with no perceptible diminution, should furnish sufficient incentive to interest capital and convert what is now practically a

waste-by-product of oil-production into a means of increasing the wealth of the state and incidentally that of the men who undertake its development.

JOHANNESBURG.

Deepest Gold Mine.—For some time past it has seemed inevitable that the deepest gold mine in the world would be on the Rand. It has previously been pointed out that underground conditions here are more conducive to deep mining than in other goldfields by reason not only of the lower underground increase of temperature but likewise on account of the excellent lode-walls. It is several years since the Catlin shaft of the Jupiter mine was sunk to a vertical depth of 4243 ft. and since that date it has only been a matter of time before the following of the reef on the incline would make the Jupiter the deepest gold mine in the world. At the present time the face of the incline in the Jupiter has reached a vertical depth of 5040 ft., so that it can now lay claim to being the deepest gold mine in the world. The only probable competitor for this honour is the Morro Velho mine of the St. John Del Rey, in Brazil, but the facilities for straightforward deep mining are so much more striking at the Jupiter than at the Morro Velho, that if recent progress has added to the last recorded depth of the Brazilian mine it can only be a question of a few weeks before the Jupiter will outstrip it in the matter of vertical depth. For some time it almost seemed as though the Cinderella would lay claim to this honour before the Jupiter; indeed, if the incline shaft had been extended, there is every likelihood that the Cinderella would have become entitled to this honour, the present maximum vertical depth of the Cinderella Deep shaft on the incline being 4770 ft. There was still another possible competitor for the ultimate honour of being the deepest gold mine, namely, the Simmer Deep, which has already attained a vertical depth of nearly 4600 ft. Hence it has been confidently foreseen for some time that it was only a question of a few months before one of these Rand mines would be able to lay claim to the honour of being the deepest gold mine in the world.

[At the Morro Velho, the shaft is now being sunk to 5500 ft. vertically below surface, at which point the 18th 'Horizon' is to be commenced early next year.—EDITOR.]

Deep Mining.—There can be no denial of the fact that deep mining on the Rand would have made far more progress had the gold contents of the banket lodes been per-

sistent in depth. This impoverishment has constituted one of the principal drawbacks to ultra-deep mining. Nothing will be gained by referring to individual mines as proof positive of this deficiency, because it prevails so extensively on the Rand that those having practical knowledge of local conditions will be able unaided to bring to mind many instances in proof of the statement. There are, of course, exceptions, the mere mention of which will not give offence to the companies concerned, such as the Brakpan and the City Deep, and it is such striking exceptions as these as will give encouragement in the future to further penetration in depth. It cannot, however, have escaped the notice of careful

when the beds were tilted rather than to the superincumbent pressure induced by mining operations. The referring of these phenomena to such occult causes no doubt carries weight in some quarters, but if the conditions surrounding the occurrence of these air-blasts are carefully investigated by those who have had practical experience of deep mining in other parts of the world, it will be found that they are more often due to previously unobserved abnormal lines of weakness in the hanging or to the fact that the method of mining in vogue is not at all adapted to the underground conditions. There has not been hitherto on the Rand that elasticity of mining methods so frequently observable in other parts



THE CITY DEEP MINE

observers that these local areas of deeper enrichment almost invariably occur in close proximity to abnormally poor or broken areas, and sometimes both, which fact, if examined closely, might possibly give a clue. Outside these few exceptions it cannot be denied that from one end of the Rand to the other the greatest drawback to deep mining has been the general decline of the gold contents of the blanket beds.

Air-blasts.—There have also been other drawbacks, for during the last two years 'air-blasts' have been unpleasantly common. The Government Mining Engineer has lately attempted to explain these occurrences by attributing them to pent-up and unreleased pressure, probably due to the original pressure

of the world, where mining conditions underground have undergone such a marked variation, but there is nothing like increasing depth of mining operations for bringing about new methods and modified systems of working.

Coal-Owners' Association.—The present Transvaal Coal-Owners' Association, whereby practically all the coal output of the Transvaal is controlled, expires next June, and it seems now as if several collieries will secede from the organization next year. It is at all times difficult to reconcile the conflicting interests of the different members and to satisfy their output requirements, but it cannot be denied that the interests of the large collieries have been well served in the past by the Association. There are, however, numerous

complaints among the smaller concerns, who are not wanted in the Association, of the undignified treatment to which they are subjected by the officials of the Association, as well as among the coal merchants. On this account the Association is anything but popular.

Puffing Extraordinary.—Mining in the Transvaal does not as a rule require much puffing in the London financial press. When such paragraphs appear it ought to be sufficient to put speculators on the alert. In the *African World* of August 17, appears a remarkable cable about the Montrose diamond mine near Pretoria, from the 'Special Commissioner,' in which the mine and its present management were extolled almost out of recognition. Other similar flattering cables, apparently originating from the special mining correspondent of the *African World* in Johannesburg, have previously appeared, but if they appeared only in the *African World* it would not perhaps matter so much. They are, however, frequently inserted in some of the leading financial papers of your City and are therefore widely read. To show how much value the Montrose diamond mine possesses, David Draper, one of our most reliable local geologists, after prospecting and working the property for over a year on behalf of the company, pronounced it a complete failure, and recommended the directors to close it down, as after the thorough manner in which it had been prospected by a predecessor, Mr. Kessler, there did not appear to be the slightest chance of discovering a profitable pipe. Such cables as those sent by the 'Special Commissioner' of the *African World* are not calculated to enhance the value of the property in the eyes of those who know anything about diamond mining, but are more likely to cast discredit upon diamond mining at a time when there is a revival of interest, such as perhaps does not exist at present in any other branch of mining in South Africa.

Underground Conditions.—There can be no denial of the fact that since the Miners' Phthisis Act came into force the conditions underground have been much improved, more particularly as regards the application of water for the purpose of laying dust. Many of the miners complain that the underground officials are now, if anything, too zealous in the matter, displaying as much unnecessary anxiety in the matter of applying water as they showed neglect before the passing of recent legislation. There has also been considerable improvement in the matter of mine ventilation,

but the greatest difficulty is experienced in getting the current of air to pass where it is most needed. This is due to the open condition of the workings, enabling the air to short-circuit through the old workings and stopes, in a way that not even an elaborate system of brick stoppings would wholly prevent. Many of the methods of ventilation have also been ill-considered, and in several deep-level mines cannot be regarded as a complete success. The most difficult of the kind on the Rand is in connection with the Cinderella Deep, where the deepest workings are about 4400 feet from the surface. Until quite recently, the Cinderella Deep had only a single shaft. Even since an underground connection was secured with the Cason workings of the East Rand Proprietary, the conditions as regards ventilation have not been improved. The temperature runs in some places as high as 92°F., simply because the air is not forced to circulate properly. Such a temperature is out of proportion with the depth and results in a marked decline in the efficiency of the underground workers. Another ventilation scheme at the Village Deep has answered fairly well as far as the greater portion of the Village Deep mine is concerned, but it is for the moment unfortunate that the underground workings of the Village Main Reef have been converted into return-airways instead of using one of the shafts on the Village Deep property. Still, the drawback may be considered as temporary, for the Village Main Reef has only a short life in front of it, and the planning of the ventilation on these lines indicates an early amalgamation of the two properties. The explanation, of course, is that there is less 'drag' in using the Village Main workings as a return than there would have been by making use of the divided compartments of the rectangular shaft, but the effects on some parts of the Village Main workings are anything but pleasant. The efficiency of a ventilation scheme, as most mining engineers know, does not so much depend upon the total amount of air passed through the underground workings as the method in which it is distributed to the working-faces, a fact not yet fully recognized on the Rand.

Mine Managers' Examination.—In a recent issue of the local mining journal there appeared an article supporting the view that an experienced engineer should not be compelled to pass an examination in the elements of mining before becoming entitled to a manager's certificate of competency, on the grounds that it was humiliating to a consulting engi-

neer to have to pass in a subject he had probably long forgotten, and that such a condition of affairs led to the appointment of dummy managers. It was contended also that it ought to be sufficient for such an experienced engineer to pass an examination in mining law and regulations. Now, it must not be overlooked that consulting engineers on the Rand are selected on account of their supposed superior experience, and are expected to advise the manager in questions of a difficult nature. It does, therefore, seem somewhat strange that an appeal should be considered necessary on behalf of a consulting engineer to enable him

their reign is cut short by failure to observe elementary principles. Taking the consulting engineers as a whole, they lack practical rather than theoretical knowledge of mining, and it does not seem flattering to them as a body that the local mining journal should take up cudgels on their behalf on the ground that they have forgotten elementary principles. Some justifiable discussion was recently aroused concerning the appointment of mine inspectors who failed to possess a mine manager's certificate, and it was shown that the duties of some of these inspectors had not been carried out in a satisfactory manner.

to slip through an examination absolutely imperative for a subordinate to pass. Rather, for the sake of efficiency, a consulting engineer actually engaged in supervising the work of a manager ought to be compelled to pass a more advanced examination than that of a manager, and at all events any consulting engineer unable to pass an examination in the elements of mining ought to be considered as unfitted for such a superior position; in fact, some would go even further and say that unless a consulting engineer has actually acted some considerable time in the capacity of a mine manager, he can scarcely be considered fit to act as a consultant. Some of the consulting engineers on the Rand may have been only surveyors or lecturers on mining, and never served as managers on an important mine. The most successful consulting engineer for practical mining ought to be one who has had experience as a certificated mine manager, and for him no easing of the examination conditions is necessary. As for dummy managers, they are only appointed when they have proved themselves incapable of passing the examination, or are closely related to a director. Somebody is generally appointed as assistant manager to keep them right, but more frequently



A Part of Victoria.

MELBOURNE.

A New Lead Mine.—The most interesting find for some time is in the western district of New South Wales. There on one of the outlying sheep stations, McClure, a prospector, set to work on one of the big gossan outcrops in the neighbourhood. He was backed by a local squatter named McPhillimay, and after much disappointing work, a splendid body of lead carbonate was opened up. The new find was known at first as the Mineral Hill, but it has been transformed into the Iodide and sold to a Sydney company

with the result that McPhillimay has made £50,000 and McClure has been relieved of the necessity to work for the rest of his life. The deposit so far is only partly developed, but at a depth of over 100 ft. the orebody has an average width of 25 ft. consisting of high-grade oxidized lead ore which also carries gold. The ore developed is worth £100,000, so that a fair mining start has been made by this juvenile. The district has been examined for minerals for years past, but nothing of importance was discovered until now.

Broken Hill.—The news has leaked out that the North Broken Hill board proposes to divide the shares of the company so as to make the capital of the company £600,000 in £1 shares against £200,000 in £1 shares, the present register. This fact is mentioned because it means the adoption of a policy that will not be favoured by the board of the South Broken Hill Co., though the directors of the company have been pressed to sub-divide the shares. Developments at the North Broken Hill mine are satisfactory inasmuch as at 1250 ft. the southern shoot of ore has been proved to range in width from 50 ft. to 120 ft. If at 1400 ft. this shoot of ore should be found to retain its size, another million tons of ore will be added to the reserves of this splendid property. At the same time the ore has been proved to be of higher value in the cross-cuts driven at the 1250-ft. than at the 1100-ft. level. While these developments have been so encouraging at the North mine, those at the British are far less promising. There the grade of the ore handled has at times sunk below 12%, and it has been made abundantly clear that had the price of metals not kept so high, losses would have had to be faced instead of small profits having been earned. Opinions respecting the property have therefore had to be modified, and it can be accepted that while Mr. Woodhead's estimate of 2,000,000 tons will be realized, the assay-values expected will not be obtained. Bores have been followed, and where good assays were reported, low-grade sulphides have had to be broken. General satisfaction is expressed that G. C. Klug, general manager for Bewick, Moreing & Co., has been appointed consulting engineer to the company. The organization under his direction should be modernized and the treatment plant improved.

Western Australia still wants a new mineral district to revive interest in it as a mining region. Odd discoveries are reported here and there, but no discovery of any extent is an-

nounced. At Kalgoorlie the wage question still occasions more or less anxiety. As the grade of the ore decreases with depth, it is evident that the wage question will have to be faced sooner or later. Indeed, that is the real problem that confronts those who want to handle low-grade formations in Western Australia. There are plenty of these, but the huge distances in the country, the cost of transport for supplies, and the high cost of living and of wages impose such a restraint on enterprise that many promising ventures have perforce to lie neglected.

In Victoria there is hope that some improvement in alluvial mining will take place. As the richest of the claims on the famous Berry leads were exhausted, the best of the class of miners who had clung to deep-lead work withdrew, and it seemed as if the end of this branch of mining was within sight. Fortunately some speculative spirits cast in their lot with the Ararat field, the result being that they pulled the Cathcart mine out of the mire after it had been handed back to local control by the British adventurers who had bought into it. Now the Central Cathcart mine to the south is furnishing splendid prospects, and is promising to average 3 oz. per fathom for the length of the gutter developed. But what is of far greater importance is that the pioneer claim on the Great Langi Logan deep lead, in the bores sent up from the level beneath it, has yielded very fine samples of gold. Should the wash in this lead give returns equal to the samples, then there will be a revival of alluvial mining greater than anything during the past ten years. It has to be understood that the course of these ancient rivers has to be determined by bores put down from the surface through the overlying basalt and drift to the Silurian rock over which the river once meandered. Should the prospects obtained from these drills be good, there is great encouragement to open up the leads from rises put up from levels driven below the bed of the gutter. In the case of the new Langi Logan leases, the bores were the best ever sunk in Victoria. All the members of the original boring party that tried to get into the wash were ruined when their shafts collapsed, and the ground has remained undeveloped until now, a period of thirty years. In the lower reaches of the lead a bore sunk some miles to the south of the old shafts has just yielded even better prospects than those now referred to. Apart from these developments mining in Victoria is deplorably dull, and there seems no prospect of any improvement.

DISCUSSION

Our readers are invited to criticise anything appearing in this magazine and to discuss other subjects of general technical interest.

Institutes as Publishers.

The Editor:

Sir—In reference to your editorial on this subject in your August issue, I should like to state something against the curtailing of the publications.

I have met many members of different societies in various parts of the world, and invariably when the subject cropped up, appreciation was expressed of the value of the publications. A very large percentage of the members never have the opportunity to take advantage of the libraries nor do they ever have the chance to attend meetings, where they can derive the benefits which you mention in your article. I believe that a large number of the members of the Institution of Mining and Metallurgy, and of the American Institute of Mining Engineers join and keep up their memberships because they wish it to be known to their friends, and those who employ them, that they are members, but a proportion of these, even, would withdraw if they did not receive a paper occasionally that applied to their particular branch of work.

FRANCIS DRAKE.

Bulawayo, Rhodesia, September 16.

M.I.M.M. or M.I.C.E.

The Editor:

Sir—Your remarks under this head are not in the tone of good temper, tolerance, and broadmindedness that have usually characterized *The Mining Magazine*. I do not think that many members of the Institution of Mining and Metallurgy will agree with you.

How often do the duties of a mining engineer call upon him to build dams, pipe-lines, ditches, and light railways, and face transport difficulties at ports of entry and on rivers? These are strictly speaking not mining, but civil engineering, and your quips as to fellows of the Royal College of Surgeons being more suitable advisers are, to my mind, ill chosen. Again, why should those who, like myself, were included in the time honoured rolls of the Institution of Civil Engineers many years before the Institution of Mining and Metallurgy was founded or even thought of, forego the justly appreciated diploma because forsooth it might be construed that they were flaunting it in the face of their brethren who did not possess and perhaps never sought the distinction?

No one could feel more *esprit de corps* for

the Institution of Mining and Metallurgy than I do myself, and I value all the privileges it confers. I therefore deprecate anything that strikes a jarring note between this Institution and the very much older and deservedly illustrious Institution of Civil Engineers. As a matter of good taste I ask you to suppress my name or reject my letter. My reasons for asking this will be obvious.

M.I.C.E.

Sekondi, September 27.

Unreliability of Ore-Tests.

The Editor:

Sir—When in Western Australia, I repeatedly saw evidence of misguidance due to laboratory tests conducted in connection with new treatment processes, owing to details of practice not being accurately followed. As some of these incorrect results have been responsible for vast losses, the importance of the matter is evident. The amenability of ores to the usual Kalgoorlie wet process provides specific instances of this. Some of them were fortunately discovered by subsequent checking.

In the Kalgoorlie wet treatment the ore is coarse-crushed and then crushed finer, with intermediate stages of concentration. The concentrate (about 5% of the ore) is roasted, and after cyanide treatment, the residue is as low in gold as is the remaining 95% of the ore that is all-slimed and raw-treated.

In the laboratory it was too often customary to crush the trial sample through 200-mesh, then remove the concentrate by panning, to be treated separately from the slime. This procedure was absolutely different from that which it was intended to imitate, in that the process on the large scale arrests much of the concentrate in the coarse condition without its being further crushed to slime and so partly lost; in other words the real process only slimed the ore after the removal of a large part of the concentrate, while the laboratory test reduced everything to a slime at once.

As previously stated, the concentrate-residue shows in many cases as low a gold content as the slime-residue; hence the disadvantage the wet process suffers in the laboratory test.

In Cornwall, when milling a fairly even grade of ore, it is possible to derive a factor which will serve for the conversion of the result of the vanning-assay into the approximate result to be expected by the chemical assay or the reverse. Thus we can formulate in our minds on the chemical basis, immediately on receipt of the vanning-assay, the actual con-

tent of the ore and the residue-loss. But only by recognizing that each mill-product requires a special factor have we been enabled to do this. The vanning-assay is not a copy of ordinary tin-dressing operations, and this point should be remembered in testing samples of ore by this method. In sizing assays, so necessary for guidance in all milling and concentrating operations, no reliance can be placed on vanning-assay results. Every assayer will remember the anxious moments spent in checking the proportional average value with the assay-value of the sample. With the varying loss in each sizing assay by vanning, there can be no expectation of doing this, and the results obtained therefore are of little or no service.

In the metallurgical sheet at the Carn Brea & Tincroft showing our monthly tin account we have been compelled to use the chemical assay. By doing so only was it possible to strike a balance of ore-content with residue-loss and recovery.

It cannot be denied that the continued use of the vanning-assay with the incomplete results furnished by it is responsible largely for the slow advance made in the metallurgy of tin. We all know the old Cornish fusion assay for copper. This was first ousted by the cyanide assay, which is now relegated for plant purposes, and later by the electrolytic assay.

Surely an analogy can be made between the two metals and, equally so can we not hope, as has been shown in the wonderful progress made in the metallurgy of copper, as great an advance in the metallurgy of tin? It might not be out of place here to go further and say that processes themselves are sometimes condemned on account of the poor results that are obtained from an incorrect adaptation, as in milling a refractory ore through coarse grates, with flint-mills or other sliming machinery to follow, without stage or intermediate concentration when this is a material factor.

E. S. KING.

Redruth, October 15.

The Engineer in the Tropics.

The Editor :

Sir—I was much interested in the article on 'The Engineer in the Tropics,' which appeared in the August number of your magazine, for I have often thought that the employers of men in the Tropics pay too little attention to the way the employee looks after his health. My experience may be of use to others. About five years before I left England, I fell off in health considerably. My blood got out of order through

constipation. I am pleased to say I did not make the common error of trying to get over the trouble by taking a lot of medicine, but set about curing myself by more natural means, eventually putting myself in the hands of Mr. Eustace Miles. I picked up in a most remarkable manner, and always kept fit. The chief part of the cure was careful diet, which included the minimum amount of meat.

When I first came to India people told me that my diet would not do for the Tropics. I decided to give the Anglo-Indian meat diet a trial. I absolutely went to pieces, and actually had ague before I had been in the country two months, in spite of the fact that it was the cold and most healthy season. After four months in the country, according to everybody, I was a "physical wreck." I came to the conclusion that something had to be done. I started with a 'fast' which lasted about 6 days, during which time I took nothing but water and a little tea. Since then I have resumed my old diet, taking the minimum of meat; and the result has been marvellous. I have had no fever since, and, at the time of writing, I can safely say I have never felt fitter.

Now, Mr. Carter's article, in my opinion, is good and practical; plenty of attention is paid to cure but not quite enough to prevention. I don't mean to dispute the fact that the mosquito is a conveyor of malaria, but if the blood is in good order, the mosquito has little effect. So it is a question of how to keep the blood in good order, and my views are something as follows:

First and foremost comes diet. This must be nourishing and digestible, and pleasant to the taste and the eye. The nourishment (proteid) is found chiefly in meat, cheese, eggs, nuts, pulses (peas, beans, and lentils), and dried milk. In addition to these foods other things have to be taken to make up bulk and to cleanse the blood; this we find in vegetables, fruit, oil, &c.

Cooking is also important, especially in the case of vegetables. Most cooks throw away the most valuable part of the vegetable, namely, the juice.

Drinking is also an important point. Most people will agree that alcohol can be done without easily enough, and if taken in anything but moderation the result is fatal. Pure water is, of course, the ideal, but soda and tea (not too strong) seem harmless. Drinking at meals is objectionable, for most people.

Mastication of all food is a point often over-looked, but I feel sure that it is well worth a good deal of time to acquire. People

seem to forget that the stomach has no teeth.

Exercise is recognized by everybody as being important, but there are few who know how to take it properly. One often hears it said that "walking is a good exercise," but ordinary walking does little to excite a sluggish liver; a few bending movements will do more good than any amount of strolling. Most games are excellent: tennis, golf, hockey, football, and, best of all, riding. Breathing too is well worthy of a little attention; it is well understood that the more oxygen we can inhale the better.

This, of course, is a subject about which much could be written, and I should think it would not be out of place to get some people who have spent a number of years in the Tropics to give us their experiences through your magazine.

W.H.E.

Kamptee, India, September 25.

Rand Problems.

The Editor:

Sir—Your timely reference to Rand problems serves as a reminder of the incalculable advantage to an industry of intelligent consideration from an outside standpoint. Thus the report of Mr. Ross E. Browne on costs and methods prevailing in other goldfields proved of the utmost advantage to the Rand, and indeed paved the way to that lowering of working cost which was such a feature in the returns of two or three years ago.

Your statement that the most material benefit may not improbably arise from increased attention to underground methods will probably prove an accurate forecast, but there are two other aspects which I venture to suggest should be considered in any discussion of problems affecting the Rand today. In the first place, the Rand suffers from the lack of a controlling financial head of the type of the late Alfred Beit or Cecil Rhodes. In the second place, the Rand suffers from an apparent inability to secure or retain the services of technical men of the type which was responsible for making the Rand famous. The second aspect really arises out of the first. Joined to the wonderful mastery of organization displayed by the late Mr. Beit was the ability to select men who undoubtedly proved themselves to be the pick of the technical world. If we regard the calamities of the last year or so that have fallen so heavily on the Rand and proved so severe a disappointment to investors, we find that in each case the trouble may be fairly assumed to have arisen from the absence of the man formerly in control of operations at

each particular centre, or in one case from the inability of the technical man in charge to foresee and provide for results which might readily have been foreseen—which as a matter of fact were foreseen—and remedies for which were at hand and available. Thus, if we take, for example, the fiascos of the Bantjes, the City Deep, the East Rand, and the Benoni, we are fairly safe in assuming that if J. R. Williams had been still in charge of the reduction operations of the Corner House group then the Bantjes plant would have been designed differently, with results at least approximating to 90% recovery from the outset. Again, it is impossible to believe that if George E. Webber or W. W. Mein had been in charge we should have been faced with the inability of the City Deep to break and bring to surface sufficient ore to keep its mill going in spite of the many years of preparation. It is merely to reiterate a truism to add that if Frederick Hellmann had continued at the East Rand we should have been spared the East Rand scandal; and as for the Benoni fiasco, one is led to wonder how useful results can accrue to the industry from the Mines Trials Committee when the chairman takes so well-proved a process as air-agitation and makes so lamentable a failure of it for lack of even the most ordinary understanding of the conditions governing the employment of this method.

Given at the head of the industry such a man as the late Alfred Beit, it is obvious that these scandals, or at least three of them, could not have arisen. Until someone is found capable of filling his shoes, investors must still be liable to the gravest doubts as to the wisdom of investing in Rand undertakings.

There is yet another aspect to be dealt with, and that is the absence at Cape Town, for so long a period of the year, of the local controlling interests. It cannot be doubted that the policy of raising small issues ("pin pricks") has not improved the relations between the mining party and the Government, and has not improved the position of the party itself: indeed a forecast might not be inaccurate which reduced the strength in the House of the mining party after the next elections to half its present strength, a number of the seats going to the Government, and a portion of the remainder being captured by the labour party.

All the above points to something being locally wrong, and I therefore return to my first point: what the industry most urgently needs now is an outstanding man.

AFRICANUS OLIM ET SEMPER.

London, October 29.

Debentures in Mining.

The Editor:

Sir—I have read the article by Mr. H. C. Hoover entitled 'Mine Valuation and Mine Finance,' appearing in your issue of October. As I understand it, along broad lines, Mr. Hoover suggests the issuing of debentures when a mine is taken over by a public company, to the extent of the net value of the ore reserves. In this way the known tangible assets will be secured, the future possibilities of the property being represented by ordinary shares. These relatively different certificates will succinctly define that which is known and that which is speculative. While it is evident that the use of debentures in this way is novel and at the same time capable of practical application, I submit that its usefulness is limited to an epoch in the life of a mine.

It is possible for an enterprise to start its career as a public company with only a relatively small ore reserve, the major asset of the company being represented by unexplored ground. Under such circumstances, Mr. Hoover proposes to pile up a debenture debt against the company to the extent of the known assets. If more money is subsequently required, it is difficult to see how it is going to be raised. Many properties are under active and able development where the money necessary to carry out development could not be secured by known assets. I believe Mr. Hoover, like many others, here falls a victim in endeavouring to conduct mining along banking lines.

However, viewing the proposal in its broad aspect, it is obvious that the assets of a mining company that existed at the time of the promotion only are safeguarded, and that the future must take care of itself. Assets in the shape of ore reserves in an active mine are constantly being consumed, and additional reserves developed. Whether an investor buys at the inception of the enterprise or subsequently, he is forced to pay for a proportion of the ore reserves as represented in each share he buys. Why only protect the original purchaser? As mines are always drawing nearer their exhaustion, why protect those who get in at the start with everything before them, and allow those who buy the shares afterwards to shift for themselves? In my judgment, the aforesaid application of debentures is only a palliation to the necessity for the amortization of mining securities.

In the issue of the *Mining and Scientific Press* of December 9, 1911, I wrote an article entitled 'Conservation of Investments in Gold

Mines.' This described a practical method of capital amortization that should protect investors throughout the life of a mine. In order to increase the stability of mining securities I outlined a plan whereby the risk and destruction of principal in the production of profits would be more evenly distributed throughout the life of a mine. It was my aim to originate a method whereby an investor would face much the same conditions, should he invest some years after a mine had commenced operating, as at the inception of the enterprise. For example, a mine is capitalized at \$1,000,000; the company possesses a valuable property, well equipped and well managed; and the mine goes on year after year making a net gain of \$100,000, sufficient to yield 10%. It is evident that if the regular division of these material profits continues for several years, the company will become established in public esteem. If this regularity continues until the fifth distribution of \$100,000 and at that time there is a four years supply of ore assured, it is probable that the shares would be quoted at least at par.

If the orebody pinched out in the sixth year, with four years supply assured, the position may be summarized: nine years at 10% dividend will equal \$900,000, plus the market valuation of the plant, which will vary from nothing to something, depending on efficiency and location. Any profit derived from the ends of the orebodies, together with the marketing of plant, may be considered as being absorbed by fruitless subsequent prospecting and liquidation charges. To recapitulate: the company shows a loss of \$100,000 in the face of 9 years of apparent prosperity. The loss in reality is much greater, for cumulative interest must be considered. On the one hand 8 payments of \$100,000 are paid, carrying cumulative interest from eight years down to one year as distributed; on the other hand, cumulative interest on \$1,000,000 is paid for nine years *throughout*, which is from date of inception until the last dividend payment when the calculation terminates. Taking cumulative interest at 4%, the total loss is increased to \$363,036; the cumulative interest loss alone amounting to \$263,036. If the company had been able to refund the total capital, just taking out of the ground a similar sum as invested therein, the loss through interest on \$1,000,000 would be \$279,636; cumulative interest on the capital for 10 years being \$480,240, and cumulative interest on the 9 distributions of 10% amounting to \$200,604. The difference in one year is owing to the first dividend being paid

to shareholders at the end of the first year.

In dealing with capital amortization the latent disadvantage of the industry is that each unit of ore is responsible for an automatic destruction of capital. The heavier the capital and the less the total ore in a mine, the greater the destruction per unit, and conversely. An amortization rate is therefore the percentage of dividend that can only be regarded as refunded capital; and if so treated, provided that the mine has been legitimately capitalized, will, on the mine being worked out, be found to have returned the original capital plus interest.

The systematic re-investment of capital is therefore advocated to stockholders, but the extra advantages derived from amortization of capital by mining companies, on their own part, are far-reaching, and would probably remove many of the gravest disadvantages. Most investors realize how difficult it is for mining securities to pick up after being quoted 'ex-dividend.' This is owing to the removal of values that are irredeemable, the mine being impoverished to that extent, with the concurrent destruction of a proportionate unit of capital. It is evident that if mining administrations deducted an amortization rate to re-invest in stable securities to be liquidated only on shutting-down, and compulsorily divisible by articles of association, the share certificates would carry the re-payment of capital plus cumulative interest; the capitalization automatically decreasing by the substitution of a simultaneous representation in gilt-edge securities as the orebodies are removed. A purchaser would therefore be enabled to invest at any time on a legitimate basis, as his certificates would carry the destroyed capital up to date of purchase. Under existing conditions an investor buying after a mine has refunded its initial capital, in the event of the shares being at par, is, generally speaking, doomed to disappointment; as in point of fact, only a small minority of gold-mining companies return two capitals.

In the case of vein mines, I suggest a basis of 10 years in which to mature the amortization of capital; and in event of a mine being sufficiently productive to refund the capital in a proportionately shorter time. On a 10-year basis, a mine capable, after providing operating cash, of paying 20%, only 10% would be paid as dividend. The remainder would be re-invested as outlined. On the conclusion of the tenth year, the stock of the company would carry the original capital plus cumulative interest, which would continue to increase in

proportion to the life of the mine. The administration would then be at liberty to divide profits in their entirety, and notwithstanding what underground privation should subsequently occur, the stock would be worth over par up to the last day of life.

It may be suggested, as a compromise, that when the capital of the mine has been amortized, the securities could be liquidated, and the proceeds divided. The shareholders would then have control of their proportion of amortized funds. These would be free for re-investment in other securities carrying a higher rate of interest. Superficially, this suggestion appears preferable, especially as on the liquidation of securities stockholders would virtually have the future of their mines for nothing, and the option of holding for future dividends or realizing at the market valuation. These advantages, in my judgment, are overshadowed by the fact that the amortized backing would be withdrawn at the most indispensable time, as a mine is always drawing nearer its exhaustion. A late investor would be then, as now, faced with the problem of diminishing capital on the one hand, against incoming dividends on the other.

Some years ago, a mining security was inaugurated in America called a Collateral Trust Bond. This is the nearest approach to the debenture suggested by Mr. Hoover. In many respects they seem to be synonymous, the main difference being that the American form had its inception in the idea to raise money for development or equipment without regard to the magnitude of existing ore reserves, but in respect to the necessities of the individual case. The bond formed a first lien on the property in respect to profits and principal. As an additional attraction these bonds could be converted into common stock at the option of the holder. In this way the money raised to start a new enterprise had the simultaneous attraction of being secured by the assets of the company, and the privilege of converting into common stock with its higher interest attraction; should the enterprise be successful. The main difference between this security and the debenture recommended by Mr. Hoover is that money is raised as a first lien to meet the expense of starting operations, and that in the case of Mr. Hoover's suggestion, debentures are issued to the extent of the known net value of the ore reserve, without regard to initial requirements.

MORTON WEBBER.

New York, October 28.

PERSONAL

A. H. ACKERMANN is expected shortly from Bulawayo.

G. AARONS has gone to Fairbanks, Alaska.

WILLIAM BACH has gone to Siberia for Pearse, Kingston & Browne.

H. C. BAYLDON has resigned from Hooper, Speak & Co. and the Troitzk Goldfields, to become resident manager for the Atbasar Copper Fields, in Russia.

W. K. BETTY has gone to Mexico.

F. K. BORROW has returned from the Frontino & Bolivia mines.

T. BOWYER BOWER is manager for the Ashanti Rivers & Concessions, in West Africa.

ARNOLD BRADLEY has returned from Kuskei, Northern Nigeria.

ARNOLD BRINDLEY has returned to England from Northern Nigeria.

GERALD M. BROWNE is expected in London on his return from Colorado.

GELASIO CAETANI designed the new concentration plant for the Tomboy gold mine, Colorado.

H. N. G. COBBE is in British Guiana.

GEORGE P. CHAPLIN sailed on October 13 for New Caledonia on behalf of Bruce Marriott & Co.

NOEL CUNNINGHAM is mill superintendent at the Hollinger mine, Porcupine.

H. S. DENNY is in Portugal.

J. F. ERDLETTIS is returning to the United States after a year in Siberia.

SHERBOURNE HAL-SHEPPARD has returned from Western Australia.

E. M. HAMILTON is at the Nipissing mine, Cobalt, and expects to be there for the rest of the year.

J. GORDON HARDY has left El Paso for Scotland.

T. J. HOOVER has become a director of the Mawchi Tin & Wolfram Mines.

W. D. HOLE, recently with the Cape Copper Co., is in England.

J. P. HUTCHINS is now in the South Urals, but expects to be at St. Petersburg shortly.

J. M. ILES, manager of the Rayfield, is home from Nigeria.

H. H. JOHNSON, of Johnson & Hoffmann, has returned from British Columbia.

GEORGE KINGDON, manager of Old Dominion copper mines, has returned to Arizona from St. Austell.

C. G. KLUG is on his way to England from Australia.

BELA LOW is with the Bogoslovsk Smelting Co., in Russia.

ALFRED M. MACKILLIGIN has joined the board of the Broomassie Mines.

E. T. MCCARTHY has joined the board of the Associated Gold Mines of Western Australia.

B. MAGNUS, lately manager for the Electrolytic Refining Co. at Port Kembla, has been appointed general manager for the Mount Morgan Gold Mining Company.

JOHN C. MANCE has opened an office at 12 Dalhousie Square, Calcutta.

F. A. MOSS has returned to Kalgoorlie.

HORACE G. NICHOLS has returned after a year's work in the Yenesei region, Siberia.

H. F. OLDS is home from Rhodesia.

L. C. OLIVER is superintendent of the North Anantapur mine, India.

ARTHUR L. PEARSE left London on October 26 on a tour of inspection in Spain.

W. PELLEW-HARVEY has returned from Tiflis, in the Caucasus.

LAURENCE PITBLADO sailed for Chile on October 25.

C. W. PURINGTON is due in London from Alaska on November 14.

EDGAR RICKARD won the recent bogey competition of the Mining and Metallurgical Golf Association.

C. M. ROLKER has returned from South-West Africa.

H. SHARPLEY has gone to South Africa.

H. N. SPICER passed through London on his return from South Africa to Denver.

V. F. STANLEY LOW has gone to Russia.

NORMAN STINES is returning to San Francisco from Vladivostok, by way of Shanghai.

HENRY C. TAYLOR, of John Taylor & Sons, sails for India on November 29.

H. A. TITCOMB has returned from Siberia.

W. TRURAN on November 7 for the Argentine to undertake the position of mine superintendent for the Famatina company.

SCOTT TURNER is expected from Spitzbergen.

MORTON WEBBER has returned from Canada to New York.

W. H. WOODHEAD has returned to Broken Hill.

C. H. WRAY was recently in Sardinia.

GOSSAN OUTCROPS OF CUPRIFEROUS PYRITE

Indications of copper deposits. Effects of weathering. Examples in the Ural region.

By H. W. TURNER.

FOR the advancement of the mineral industry there is probably no field for the mining geologist that promises so much in the way of new discoveries as the investigation of the outcrops of ore deposits. Many valuable papers have been written, but these deal chiefly with the changes that have brought about secondary enrichment, which is admittedly a matter of great practical importance and directly connected with the subject in hand.

the possibility of valuable deposits below. But when the gossan is found in igneous rocks or in metamorphic schists there is often nothing visible to tell the story. If on assay, gold and silver are found to be present, it is probable that the sulphide ore in depth contains the precious metals together with copper, but as some cupriferous pyrite lenses contain only traces of gold and silver, the occurrence of a gossan containing only traces does not prove that there



Photo by

P. P. OF TISSOFF PYRITE LENS, KYSHTIM

T. Jones

It is the purpose of this article however to look at the matter from the view-point of the prospector, who has only surface indications at his disposal, and to draw attention to the desirability of marshalling all the facts that will assist the intelligent prospector and the mining geologist in determining the nature of a deposit in depth from the oxidized outcrop.

It is a matter of common knowledge to mining engineers that the upper portion of solid pyrite orebodies is, in regions of oxidation, a rusty gossan composed mainly of iron oxides with silica or sometimes barite. When the deposit is in limestone and the pyrite is cupriferous, there are usually carbonates and oxides of copper present to suggest to the prospector

is not a deposit of copper below. In most such gossans the copper content has nearly all been leached by percolating acid waters, as at Rio Tinto, Butte, and in the Urals.

The relation of gossans to copper deposits in depth has been brought out in a striking manner at many of the great mines of the world and is well known even to mining investors. At many of the mines the evidence of ore in depth was clear and simple, there being gold and silver in the gossan, as at Mt. Lyell in Tasmania, Iron Mountain in California, and the Kyshtim copper mines in Russia.

What is now wanted is evidence of the nature of the ore where the leaching has been so vigorous that in light of our present know-

ledge we can predict nothing as to what is underneath, as for example at Butte, Montana, where the discovery of the copper was made in prospecting adjoining silver veins. This discovery was, in other words, an accident. To get this evidence requires detailed investigations such as were started by Stephen H. Emmons*, in regard to gossans of sulphide deposits, and continued by W. H. Emmons† in regard to manganese lodes. Emmons has shown that in gold lodes containing manganese, the gold is leached out by chloride solutions and carried down to lower levels. We may therefore modify the old rule that if a gold quartz vein shows a low content of gold at the outcrop, it is not likely to be of value in depth, when we find the quartz stained with manganese oxides.

Until exact chemical analyses have been made of many gossans giving the unusual as well as the common elements, with similar analyses of the underlying ores for comparison, it cannot be told what the practical results will be. But that such investigations are well warranted seems clear, for if favourable results are obtained, the saving in the cost of prospecting will be important. In certain areas of decomposed igneous rocks in Brazil, Derby was able to tell the nature of the underlying rocks from the accessory mineral constituents which resisted oxidation. It is possible that in the same way some of the accessory constituents of veins in their gossans may give a clue as to what is below.

Composition of Pyrite Gossans.—The chief constituent of a gossan of a pyritic orebody is iron oxide usually occurring as brown hematite or limonite, with silica in excess of 10%. But limonite may result from the oxidation of carbonate of iron, and a carbonate gossan does not differ materially in appearance from a pyrite gossan. On the other hand a carbonate gossan often contains less than 10% of silica, and would of course with a pure carbonate ore contain none at all, while there is practically always with the so-called solid pyrite a certain amount of interstitial silicates, and usually vein quartz. The carbonate of iron deposits; moreover usually occur in sedimentary rocks and mostly in calcareous rocks, so that a limonite gossan found in igneous rocks or in metamorphic schists, indicates in most cases a pyritic orebody.

Silica is always present in pyrite gossans, but this does not necessarily mean that the underlying pyrite will be of a silicious character from the smelter's standpoint. The gossan of the Behlorechensky pyrite lens in the Urals contains 17% of SiO_2 , while the underlying pyrite contains only 1.5%. The gossan of some of the pyrrhotite lenses at Ducktown, Tennessee, was mined for a number of years as iron ore, and the silica content is given as 19%, yet the underlying pyrite contains only about 10% SiO_2 . This is easily accounted for, since, the silica being relatively insoluble, the larger part of it remains in the gossan, while the more soluble contents are removed in greater proportion, and the percentage of silica in the residual gossan becomes greater.

Barite is often present up to 20% or more, and as this mineral is a common constituent of pyritic copper ores, its presence in gossan in igneous rocks and schists may be an indication of copper in depth. Here again the relative insolubility of barite causes the percentage in the gossan to be greater than in the underlying pyrite. Barite is found in the pyrite of Mt. Lyell, Rio Tinto, Rammelsberg, and Meggen, Germany, in the copper mines of the Kyshtim Estate in the Urals, and elsewhere. Manganese oxide is present in nearly all gossans derived directly from siderite, to the extent of 2% or more, while gossans derived directly from pyrite usually contain less than 1 per cent. Limonite of sedimentary origin like the Clinton iron ore of the Appalachians likewise contains less than 1% of manganese oxide. In addition there are many elements present in varying amounts of which gold, silver, and copper are the most significant, and to these reference has already been made. What is to be hoped for is that future investigations will add to this list.

Physical Aspect of a Pyrite Gossan.—It is often stated that the gossan of pyritic origin is scoriaceous, and this is often true, particularly at the surface, but not necessarily true in depth, as the iron solutions travel to some extent and form compact iron ore as is exemplified in some Ural deposits known to have formed from pyrite. Wetzig[‡] states that at Rio Tinto the nature of the gossan is an index to the character of the underlying orebody; where the former is red hematite, the underlying pyrite is compact and poor in copper; where the gossan is yellow, porous, and ochreous, pyrite rich in copper may be looked for in depth.

Depth of Alteration.—The mining geo-

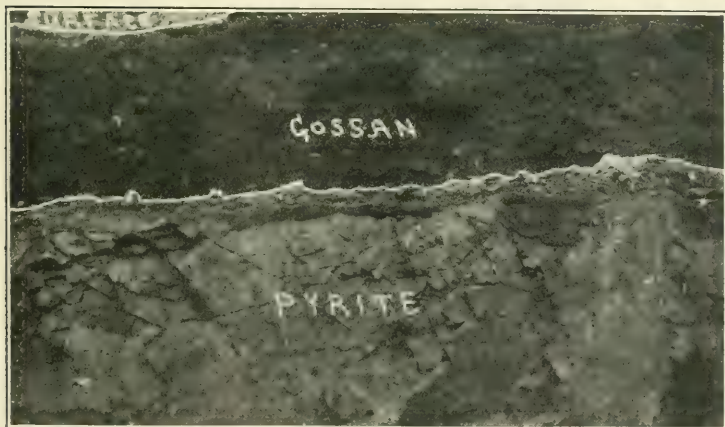
* *Eng. and Min. Journal* Vol. 51, 1892.

† *Trans. Am. Inst. Min. Eng.* Vol. XLII, 1910.

‡ Carbonate of iron or siderite is likewise common in fissure veins. The deposits here referred to are those common in the Urals, which have a distinctly bedded character, and are usually found in the Permian carboniferous rocks of the west slope of the mountain in Devonian rocks also associated with limestone.



THE SHELYALINSKY IRON MINE, UFALET ESTATE.



JUNCTION OF GOSSAN AND PYRITE

logist having found a gossan outcrop that promises to lead to ore in depth, the mining investor will want to know how deep he must go to determine the matter. In a general way sulphide deposits are usually oxidized to the level of the ground water, where the rocks are permanently saturated and oxidation can no longer take place. This water surface is not in fact level, but to some extent rises with the contour of the surface.* Thus the oxidation of the Koniukhoff lode on the Kyshtim Estate extends to a depth of about 200 ft. and the water of the adjoining Soymonovsk Valley lies 350 ft. below the outcrop of the lode, or 150 ft. below the limit of oxidation, showing a rise in the water level from the valley to the mine of 150 ft. On the other hand the oxidized zone of the south end of the Tissoff mine on the same estate is only a few feet in thickness, the deposit there being under what was originally a marsh and thus practically at water level.

To take another example, the outcrop of the Kyshtim iron deposit is only about 40 ft. above the adjacent water level, while oxidation is known to have extended to a depth of about 200 ft. But here the ore occurs along limestone layers, and this rock being easily soluble allows the surface waters to eat their way to a greater depth. More or less of the limonite of this mine is probably derived from pyrite disseminated in schist, as deep bores under the deposit encountered no solid pyrite, but only schist impregnated with pyrite and interbedded with marble.

The following table will give an approximate notion of depths of oxidation in certain districts:

DEPTHS OF OXIDATION OF PYRITIC COPPER
DEPOSITS.

Koniukhoff Mine, Ural Mts.....	200 ft.
Tissoff Mine on the marsh, Ural Mts....	5 ft.
" " on the hill, "	60 ft.
Behlorenchensky pyrite lens "	20 ft.
Ducktown, Tennessee "	17 to 80 ft
Butte, Montana "	10 to 400 ft.
Rio Tinto, Spain.....	30 to 160 ft.

H. V. Winchell in a recent article† expresses an optimistic view of the probability of many important discoveries being made, through the systematic prospecting of gossans, and refers to the famous Butte copper veins, the gossans of which were apparently absolutely barren. Winchell writes: "There is scarcely a trace of copper in the outcrop nor within the upper 100 ft. of the most important veins of the

camp. . . . How many more such deposits may still lie ready to reward the efforts of the intelligent prospector or the investigations of the up-to-date mining geologist there is no possibility of telling."

In no portion of the world is this better exemplified than in the Urals, which are well sprinkled with limonite deposits representing in many cases oxidized pyritic deposits. This limonite for 200 years and more has formed the chief basis of the Ural iron mining industry, although magnetite deposits of a different origin have likewise contributed. While limonite sometimes forms as an original deposit—bog iron ore—the evidence goes to show that most of the Ural deposits are secondary and in fact true gossans, although some of those on the western flank of the Urals in Permo-Carboniferous sedimentary rocks are known to have resulted from the oxidation of bedded siderite deposits. Most of the limonite deposits of the Urals in igneous rocks or metamorphic schists probably cap pyritic lenses or zones of highly pyritic schists. Nearly all of the pyritic lenses of the Urals have been discovered by digging on limonite outcrops, primarily for iron ore. In four of them, however, the comparatively recent discovery of precious metals in the gossan forming an ore suitable for cyanidation, led eventually to the discovery of copper in depth.

In the middle Ural region copper mining has been proceeding for more than 100 years, but the deposits mined have been of a contact-metamorphic character, as at Bogoslovsk and Nijni Tagil, north of Ekaterinburg, and at Polevskoi and Soymonovsk, to the south of Ekaterinburg. It is a significant fact that excepting the Kalata lens on the Werkh-Issetsk Estate and the Tissoff lens on the Kyshtim Estate all of the important pyritic copper deposits of the Middle Ural region have been found within the last ten years, and all of these are in metamorphic schists said by the Russian geologists to be of Devonian age or in associated igneous rocks.

The Urals form a more or less definite chain extending from the Arctic ocean to near the Ural sea, and to judge from published descriptions, the formations are essentially similar throughout the entire chain. The island of Nova Zembla represents the north continuation of the Urals, and is composed of Devonian rocks, which are known to contain vein deposits. It seems safe to predict, therefore, that many new pyritic lenses, now unsuspected, will be found in this promising metalliferous zone.

*In a dry country the water surface is an irregular one, and in limestone, or in a much fissured zone, oxidation may extend irregularly deeper than the ground water surface.

†Eng. and Min. Journal, Feb. 1, 1907.

ANALYSES OF PYRITIC ORES AND THEIR GOSSANS
FROM THE HUELVA DISTRICT, SPAIN.

	1 Tharsis pyrite	2 San Domingo pyrite	3 Rio Tinto pyrite	4 gossan	5 gossan
	%	%	%	%	%
Cu.....	3'80	5'81	3'42	0'12	trace
Fe.....	38'70	41'41	40'00		
Fe ₂ O.....				54'50	77'14
S.....	44'60	49'30	48'00	0'06	0'70
SO ₃				1'12	1'78
Zn.....	0'30	trace	trace	0'32	
Pb.....	0'58	0'66	0'82	0'70	
Mn.....					trace
Al ₂ O.....				1'38	0'67
SiO ₂	11'10	2'00	5'67	28'30	6'37
TiO ₂				0'08	
BaSO ₄				1'60	
Alkalies.....				0'74	
CaO.....	0'14	0'14	0'29	1'29	0'51
MgO.....	trace	trace	0'13	0'16	0'12
As.....	0'26	0'31	0'21	0'82	1'22
P.....				0'024	0'018
Sb.....				0'108	
Combined H ₂ O.....				7'31	5'66
Moisture.....	0'17	0'05		0'83	1'02

Analyses 1, 2, and 3 are taken from Vogt, *Zeit. f. prak. Geologie*, 1899, p. 248.

Analyses 4 and 5 represent two types of gossans that exist in vast quantity at Rio Tinto. No. 4 gossan always shows much quartz in angular fragments scattered through the mass. No. 5 gossan is more predominant as to quantity, and is essentially a limonite.

ANALYSES OF GOSSANS (LIMONITE) DERIVED FROM IRON CARBONATE
DEPOSITS.

	1	2	3	4	5	6
	%	%	%	%	%	%
Fe.....	49'12	50'18	54'58	56'10	37'40	46'89
Mn.....	2'37	1'30	2'37	2'68	4'50	5'40
SiO ₂	13'75	10'00	6'85	3'90	7'24	9'03
P.....	0'161	0'266	0'280	0'384	0'86	0'85
S.....	0'054	0'018	0'007	0'003	0'81	

Analyses 1 to 4 inclusive are taken from Katzer, *'Erzlagerstätten Bosniens und der Herzegovina*, Wien, 1910.

Analyses 5 and 6 are of the limonite of the Tunkinsk mine on the Serguinsk datcha, southwest of Ekaterinburg, in the Urals. In depth this limonite changes to siderite, which contains some iron di-sulphide. This marcasite or pyrite contains a little copper. Judging from these analyses, limonite gossans derived from siderite contain more manganese and phosphorus, and less sulphur than gossans derived from pyrite.

METAL MARKETS

COPPER.

Average prices of cash standard copper :

Oct. 1912	Sept. 1912	Oct. 1911
£76. 10s. 7d.	£78. 17s. 5d.	£55. 5s. 3d.

The confidence slowly returning to this market has been severely shaken by the political drama that has shattered the nerves of Europe. The dread spectre of war, mercilessly used to slaughter prices, has brought the European bourses to the verge of panic, and along with every other speculative medium, copper has been profoundly disturbed. The price of three months metal has ranged between £80. 3s. 9d. and £72. 15s. The low level reached gave bears a tempting opportunity to cover, and much of the loss has been recovered ; but public confidence is wanting, so that speculative buying is for the moment dead, while manufacturers are confining their purchases to their immediate requirements. At the end of the month, three months copper stood at £76. 2s. 6d., but in view of the uneasy feeling prevailing the future of prices is obscure. American producers confidently assert their ability to maintain their prices for electrolytic copper, and in view of the long abstention of buyers and the continuance of prosperous trade their independence may be understood. No small factor in their determination is the continued strike at the smelter plants in Nevada and Utah. The approaching exhaustion of stocks of refined copper in European warehouses makes consumers more and more dependent on American supplies. Freight difficulties are also likely to produce important effects. Should the political horizon be cleared, a large buying movement is likely to develop.

LEAD.

Average prices of soft foreign lead :

Oct. 1912	Sept. 1912	Oct. 1911
£20. 8s. 0d.	£21. 9s. 0d.	£15. 6s. 1d.

Prices have suffered a decline. Arrivals during the whole month removed the heavy premium on spot lead, and rendered a reduction in the quotation possible. Undoubtedly the high price had been checking consumption, so that a lower level will be welcomed by consumer, dealer, and smelter alike. There is no alteration in the position in Mexico, where only limited supplies of bullion are coming forward. Spanish material is being freed by the closing of the Russian ports, and

Australian shipments are increasing. Trade demand is meagre and a revival is scarcely to be expected at this time of year.

SPELTER.

Average prices of good ordinary brands :

Oct. 1912	Sept. 1912	Oct. 1911
£27. 5s. 10d.	£26. 17s. 0d.	£27. 4s. 10d.

Prices have been strong, with a good demand throughout. At the end of the month a reduction was made in the London quotation, in sympathy with the fall in other metals, which had influenced buyers to hold off the market. They are however very busy, and have orders on hand for a long time ahead.

TIN.

Average price of cash standard tin :

Oct. 1912	Sept. 1912	Oct. 1911
£228. 13s. 8d.	£223. 19s. 6d.	£187. 2s. 9d.

In this metal a heavy fall might have been expected in view of the interference with the large trade in tinsplates for the Black Sea, but on the contrary prices show a remarkable resistance. The speculative position is conclusively shown to be small, and the market is clearly dominated by American rather than European conditions. Shipments from the Straits during October have been small and were affected by floods. For November larger shipments are anticipated, Eastern houses having sold freely at the higher prices.

SILVER.

The price of silver is showing a tendency to react, and has sunk below 29d., chiefly owing to speculators reducing their commitments consequent on the high rates for carrying-over.

OTHER METALS AND MINERALS.

Prices quoted on November 10 :

SILVER.—29d. per oz.

PLATINUM.—185s. per oz.

BISMUTH.—7s. 6d. per lb.

CADMIUM.—3s. 3d. per lb.

ALUMINIUM.—£81 to £85 per ton.

NICKEL.—£170 per ton.

ANTIMONY.—£39 to £40 per ton.

QUICKSILVER.—£7. 12s. 6d. per flask.

MANGANESE ORE.—10d. to 1s. 0½d. per unit (1%).

IRON ORE.—Cumberland hematite 26s. 6d. per ton at mine. Spanish 23s. delivered in England.

PIG IRON.—Cleveland 67s. 6d. per ton. Hematite 80s. per ton.

WOLFRAM ORE.—28s. per unit (1%).

PROSPECTING FOR TIN IN NIGERIA

By JOHN T. KEATING.

AT the outset I would point out that there is no orthodox method of prospecting for tin; it is not, therefore, my purpose to offer advice to old and experienced prospectors, but to give a short description of methods that I have used in several countries when called upon to estimate the value of alluvial ground. I write now from Northern Nigeria.

A little care and forethought in purchasing outfit will alleviate many discomforts in a country such as this. The risks of sickness are great unless one has a sufficiency of proper food and clothing. With proper attention to outfit such risks can be reduced to a minimum.

On arrival in the prescribed district, the rivers and streams will first of all occupy the prospector's attention. If tin exists, it is bound to be found in these. He will then work up stream, noting and trying the small streams or tributaries in the effort to ascertain the source from which the tin has been denuded and washed into the rivers.

In order to obtain legal rights, it will be necessary to mark out a prospecting area, placing at each corner of this a peg or beacon 6 feet high and 5 to 6 inches in diameter at the angle of an L-shaped trench, the limbs of which denote the direction of the boundaries. Application must then be made to the Government Inspector of Mines for the area enclosed; the boundaries must be cut 8 feet wide, and plans in triplicate must be transmitted, signed by a licensed surveyor holding a certificate from the Government of Northern Nigeria, together with cash or cheque in the proportion of £5 per square mile or portion thereof. This gives the exclusive right to the applicant to prospect for minerals within the prescribed area. The area is limited to 16 miles per application and must be laid out so that the length does not exceed three times the breadth.

Besides the ordinary tools, such as picks and shovels, I would recommend the prospector to include in his outfit a light set of boring tools of about 4½ in. diameter (the standard Empire set being too heavy and cumbersome) with a portable telescopic tripod made of light steam-pipe; also two No. 3 Dando Diaphragm pumps with 25-ft. lengths of flexible hose.

After deciding on the most likely ground, it would be well for the prospector to lay out his

lines with a theodolite or prismatic compass (in chess-board fashion) at distances of 100 to 200 yards, according to the nature of the ground, adhering strictly to the sinking of his pits or bores at the intersections of the lines, so as to eliminate any idea of selection afterward. If it is decided that pits be sunk, a measured quantity should be taken from every foot of the pit and placed aside as a bulk check on the main sample, which need not be taken until the pit is bottomed.

The nature of the ground should be noted in the field-book, and a small quantity of each



Working in a bank of gravel

foot sunk should be washed, the contents being weighed. This will enable the prospector to judge whether sectional sampling is necessary, and to ascertain in what portion of the pit the richest of the material is deposited. Sampling in sections is absolutely necessary in ground where the tin is not uniformly distributed throughout the whole mass, a measured (not weighed) quantity being always taken. For this purpose a box one foot cube, or a somewhat smaller division thereof, gives satisfactory results. While on this subject it would be well to point out that in some instances a cubic foot of tin-bearing ground can be cut out, cheese like, and, after being broken, can with careful ramming be replaced into the

1 cu. ft. box according to actual experience, but, on the other hand, a cubic foot of stony or gravelly earth cannot after breaking be replaced in the box by from 10 to 40% of the whole.

In cases where the sampler is not acquainted with the nature of the earth to be tested, he would be well advised to ascertain what amount of the ground represented by a cubic foot in place could be replaced, after breaking, in the sampling-box or measure. I mention the above because the common practice in sampling alluvial tin ground is to report the yield in pounds per cubic yard, and as gravels differ greatly in weight, the weighed sample should be stated against its volume in place and when broken.

In several cases that have come under my notice in Nigeria, the tin occurs from the surface down to a depth of from 5 to 20 feet, and pits have been continued as far as to 20 feet below the stanniferous clay. These pits were not sampled in sections, but a cut 4 inches wide and 2 inches deep was taken from top to bottom, passing through the stanniferous clay into barren decomposed granite, the whole material of the cut being then quartered and sampled. This, although it gave a larger area on account of the depth of the pit, reduced the average of the tin-bearing ground (which was nearer the surface) and consequently the estimated yield of the whole area.

The bottom of the bedrock having been reached, the nature of the ground noted, and the distribution of the tin oxide ascertained, the sampling can now be commenced. If, as in the case of river gravel, the richest material is found at the bottom, the overburden should be sampled separately, and its yield noted in the field-book. The 'wash' or stanniferous gravel then receives special attention. Four cuts of a uniform width and depth as nearly as possible at right angles to each other should be taken out, and a measured quantity from each treated separately. The average of the four samples will then represent the average value of the gravel in the pit.

From the sample already taken from each foot of the sinking, after mixing and quartering, a measured quantity should be taken and treated in precisely the same manner as the wash and overburden. This will give a reliable check on the whole of the ground to be treated.

The overburden having to be moved, the sampler must make an accurate survey of the area in question; in computing the contents, he must also estimate the amount of concen-

trate contained in the area, from which he can calculate the average contents of the area. For example, assume 35 acres to be the ground to be treated at an average depth of 3 yards, composed of 2 yards deep of overburden, averaging, say, 0.5 lb. tin concentrate per cubic yard, and one yard deep of 'wash' at, say, 9.5 lb. per cubic yard. Then 35 acres at 2 yards deep contains 338,800 cubic yards, which at 0.5 lb. per cubic yard carries 169,400 lb. tin concentrate; 35 acres of wash or gravel 1 yard deep is 169,400 cubic yards. This at 9.5 lb. per yard would give 1,609,300 lb. concentrate. Dividing the sum of the cubic contents into the sum of the concentrate, the result is 3.49 lb. concentrate per cubic yard. If the samples have been taken carefully this ought to be within 2% of the bulk sample obtained from all the pits.

Several varieties of tin oxide are found in Nigeria, namely, black, grey, wood tin, ruby tin, and amber tin; the first is the most common and at the same time the most difficult to identify with the naked eye, because it is commonly mixed with one or more of the following impurities: rutile, ilmenite, topaz, garnet, and wolfram.

The Royal Mint Returns show that gold bullion worth £21,673,614 was received during the year 1911; in addition, light gold coin with a face value of £2,350,000 was received for re-coinage, as well as gold coins from the United States to the value of £4,101,188 for conversion into sterling. Not counting specimen sets, the gold coin issued during the year consisted of 30,041,328 sovereigns and 6,183,001 half-sovereigns. The issue of gold coin from the branch mints in Australia was: Sydney, 2,519,000 sovereigns and 252,000 half-sovereigns; Melbourne, 2,851,451 sovereigns; Perth, 4,373,165 sovereigns and 130,377 half-sovereigns. On the light coin withdrawn from circulation, the average deficiency in weight was 2d. per sovereign and 1.6d. per half-sovereign. On June 30, 1911, the gold coin held by banks in the United Kingdom was worth £54,009,977. During 1911, the silver bullion purchased was 6,350,904 standard ounces, for which £657,153 was paid, the issue value being £1,746,498. Worn silver coin weighing 1,937,820 oz. was withdrawn from circulation. The issue of silver coin during the year had a face value of £2,381,181 and was made up as follows: crowns 4, half-crowns 2,700,856, florins 6,739,510, shillings 21,136,180, sixpences 10,082,220, and threepences 4,861,440.



CALABASHING.



WOMEN ENGAGED IN CLEANING THE CONCENTRATE.

PREMIER DIAMOND MINE

The nature of the deposit. Mining methods. Saving of labour.
Treatment of diamantiferous ground.

By RALPH STOKES.

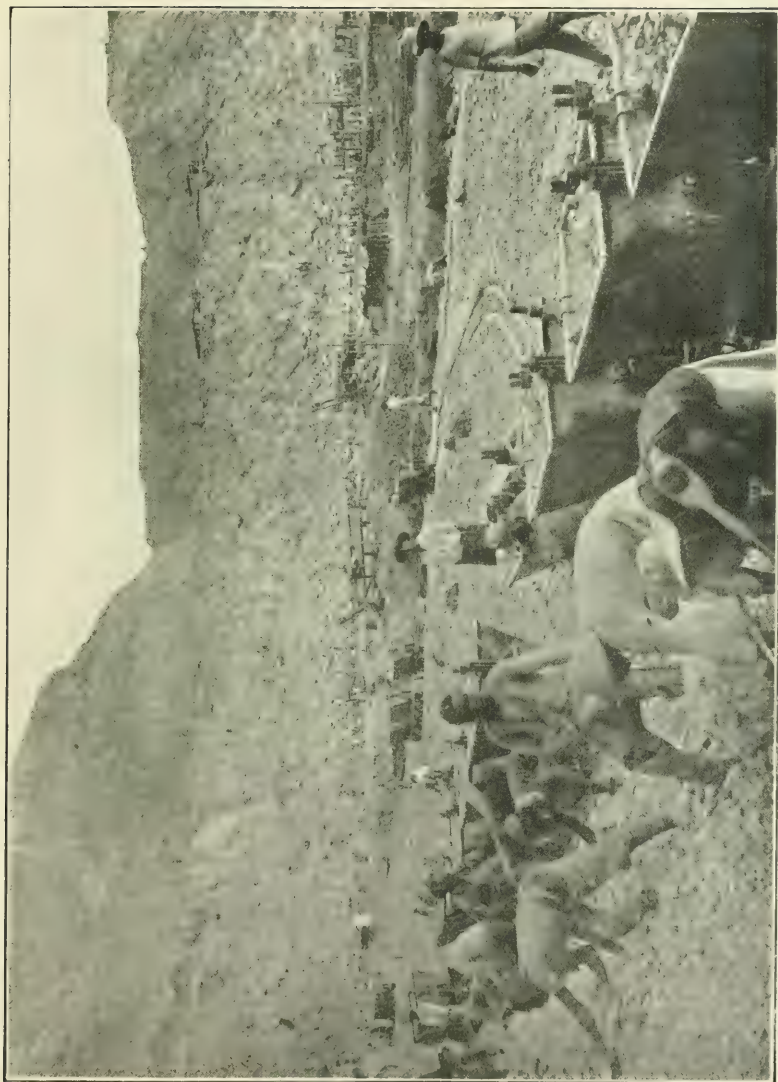
IN July, the Premier (Transvaal) Diamond Mining Co. passed a new and important landmark in its brief though remarkable history. During the calendar month, over a million loads* of ground were hauled and treated, equivalent to 10,000,000 tons per annum. This globular aggregate has peculiar import in the progress of a mine whose distinction lies in a vastness of resources and whose vitality as a profitable commercial enterprise is directly dependent upon magnitude of output. While the Rand mining engineer, fifty miles away, is anxiously concerning himself with the minor issues between the wholesale and the selective policies of mining, dubiously analysing the pros and cons of a 4-dwt. block of ore in the light of changing labour conditions or the present profitability of a 10s. foot-wall, the Premier management is faced with the unalterable task of profitably treating material with an average content of under 4s. per ton. This small value, little in excess of the Rand residue-content a few years ago, must pay for drilling, blasting, hauling, crushing, concentration, and dumping, and still leave its margin of profit (against capital expenditure on plant, works, and buildings of 1½ millions sterling) to pay dividends on a market valuation of £5,000,000, after the apportionment of 60% of realized profits to the Union Government. There is no such lavishness of natural wealth at the Premier as will make good any failure of the control to utilize fully the mine's unique facilities for cheap operation; nor is it yet too early to disregard the economic difficulties eventually to be faced when the depth of open-working becomes excessive and when the danger of wall-slips prompts the coincident introduction of underground mining. At the present rate of output (12,000,000 loads per annum), the suggested average depth of 1200 to 1500 feet for open-working means a life of 40 years. It is manifestly impossible to foresee future labour and diamond-market conditions with sufficient assurance to determine the commercial value of a grade of 20 to 25 carats (per 100 loads), which is the most reliable factor in future cal-

culations. Underground mining will, however, commence long before this distant period and will not improbably be introduced experimentally within a few years.

Descriptions of the Premier diamond mine have frequently appeared in the technical and popular Press. The story of the discovery of the mine, of the £55,000 demanded by Joachim Prinsloo before a pit was sunk upon the farm, of the blind faith of the pioneers in the significance of their observations and the wild speculations over the opposing theories of early visitors, of the rich washings in the initial stages of development, and of the finding of the Cullinan diamond in 1905—this story of sensational realities has been oft re-told. But beneath the glamour of these stirring records, there is the solid and practical aspect of the undertaking which calls for more critical attention and which the dazzled visitor is apt to appreciate scantily under the stimulating influence of big impressions. Common working methods and problems form the basis of the present article.

The area of the Premier diamond pipe is 78 acres, or half a mile long by one-third of a mile wide. The form of the mine is shown by the current working-plan published in these pages through the courtesy of the general manager. The great bar of "floating reef" or sandstone, once part of the pipe-wall, cuts across the mine at its narrowest part and thus divides it into two distinct portions. The removal of this rock, essential to future economical working, is steadily proceeding. One area, on the southeast side of the so-called 'reef,' represents a third of the mine and serves the older No. 3 haulage, while the northwestern and deeper area serves, for the most part, the new No. 4 plant. About eight per cent of the material hauled out of the mine is waste, this proportion of sandstone or quartzite being filled into separate trucks in the mine and sent out by the main haulages. The mine sorting affords few difficulties, as the waste occurs in big and well defined masses, with a distinctive character precluding all possibility of error. The working-faces at night are well illuminated by arc-lamps and seven search-lights,

* A 'load' is equal to 16 cubic feet.



CONTRACT NATIVES LOADING TRUCKS.

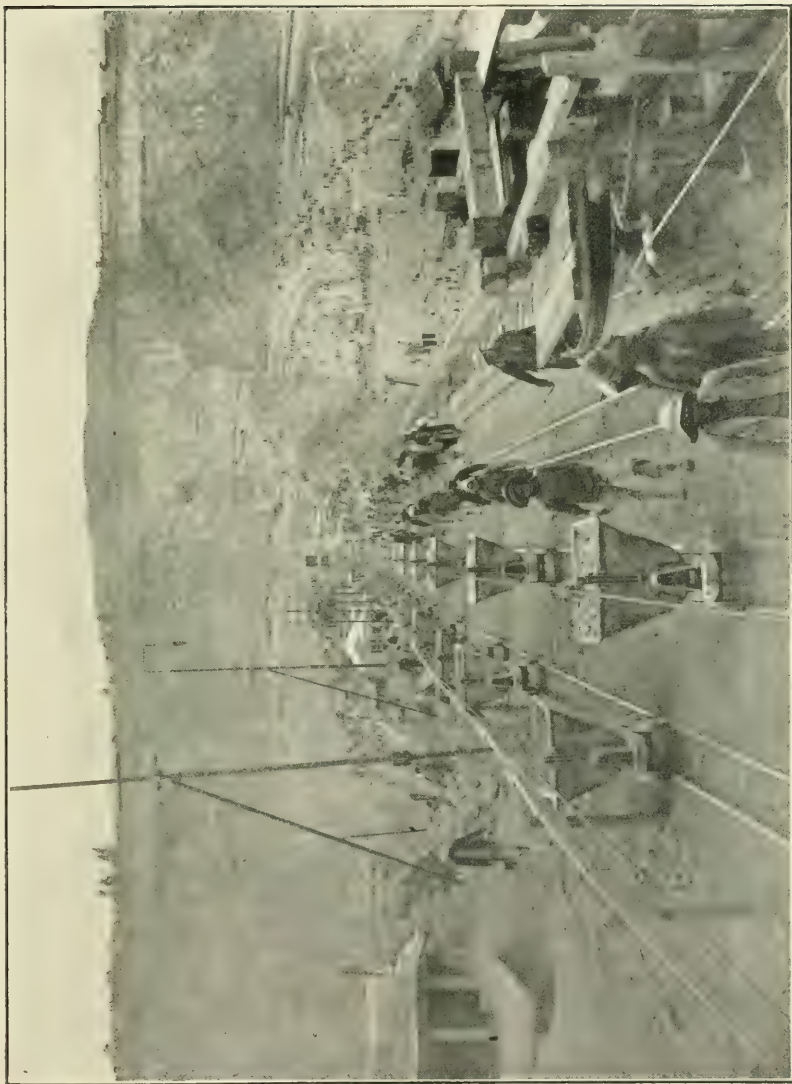
erected at surface around the rim of the pipe.

The general arrangement of the endless rope haulages, upon which smooth working and mining efficiency depend, will soon be completely re-organized. At present, the mine is served by two independent main incline endless-rope haulage-ways, which run from the two treatment-plants to the knock-out points one-third and half-way across the open-cut for the No. 3 and No. 4 plants respectively. The grade of the tracks within the mine is $1\frac{1}{2}\%$. The natural embankments, within the pipe, upon which the two haulages run down to the working level, are not only obstructive to working efficiency, but hold up over 5,000,000 loads of ground. This includes 'yellow-ground' and 'blue-ground,' as the oxidized and unoxidized varieties of kimberlite are termed. To enable this material to be worked, to provide for the requirements of deeper mining, and in course of time to facilitate a desirable scheme of uniform working throughout the area, upon the removal of the 'floating reef,' an incline tunnel or shaft has been driven from a point between the two gears at a grade of 1 in 5, so as to pass from the rim-rock into the pipe at a depth of about 250 feet. As it is impracticable, having regard to the enormous quantity handled and the length of terraces required for its production, to lay the tracks to the faces on the end-on system, a number of cut-outs have to be provided. Traffic on these loops, 200 or 300 ft. long at the faces, would be seriously impeded by inequality of efficiency in the loading and tramping 'boys'; and the organization of the gangs thus requires careful and systematic arrangement. The demands of these two haulages are heavy and call for the highest efficiency in the distribution of empties, and the rapid clearance of the loop-lines upon completion of filling. There are 2000 'cocopans' or trucks in constant employment. For 20 hours per day each haulage calls for a constant stream of 1000 trucks (of 20 cu. ft.) per hour. Under future conditions, where the arrangement is not complicated by the two haulage embankments and by the mass of rock dividing the pipe, there will be a great simplification of the tramping systems to serve the haulage roads, which will run, in extension of the newly-driven underground tunnel, in line with the central development-cut along the major axis of the pipe. There will be a reduction in the number of 'boys' on the haulage—'on-setting,' 'knocking-out,' and 'spragging'—who now number nearly 400 on each shift, owing to simplification of system. Also important in this regard will be the substitution

of a new type of 'jockey,' or clip, automatically engaging and disengaging the rope under the truck, in place of the present square-pinned top jockey, the secure application of which calls for four or five boys at the onsetting points, where the haulage-ropes are so belaboured as to shorten their period of service to only 3 or 4 months.

The outstanding opportunity for reduction in native labour lies in the introduction of small hammer-drills and pluggers. At present, the company is not provided with adequate air-power to enable machine-drilling to be undertaken on more than an experimental scale. Only three Flottmann hand-hammer drills are employed, drilling in the sandstone 'reef,' in which they can each make 50 to 60 ft. per day, and one Shaw plugger, used in moiling the big lumps of blue ground before filling the trucks. Results obtained to date have stimulated the management to hope for important economies. Further data are required of average results, of air and maintenance costs on a big scale. In 'floating reef,' now drilled by single hand-hammers, one hand-hammer machine-drill should replace more than 20 natives. True comparisons of machines and hand-labour in the 'blue' are yet hard to make. Tests, specially watched and supervised, are apt to give favourable indications of an efficiency beyond the average of every-day working conditions. In drilling 'uppers' or dry holes in the De Beers mines, hammer-drills of the Waugh and Ingersoll type have proved the equivalent of 7.5 to 9 'boys,' doing 45 ft. to 75 ft., according to the typical hardness of the different pipes. In the Premier, where down-holes will be exclusively employed for many years, the natives are able, with long 'jumpers,' to attain high efficiencies. The machines will have to compete with highly competent contract-boys, who earn on jumpers in the 'blue' nearly 3s. per day at the low rate of 2d. per foot, out of which they pay for their own food. This means a drilling cost of about 4d. per load, and allows small margin for economy.

The vital importance of introducing hammer-drills of some type, however, appears in the relief they would afford from the disturbing influences of a fluctuating labour supply. At the moment, the company's labour position is comparatively satisfactory and with 16,900 natives in the compounds (during August), the 1,000,000-load standard of monthly production should be readily maintained. Variations in labour complement at the Premier have been known to occur with surprising irregularity and for reasons peculiar to the mine. For ex-



ENDLESS-ROPE HAULAGE.

ample, the danger of faction fights among the 'boys' of different tribes collected together in great masses within the barbed-wired fences, is a significant factor. Union Day was recently celebrated with an expressive disregard for empty titles by the cracking of 50 skulls. Only 10, it is true, were beyond serviceable repair, but the humiliation of the affair weighed heavily upon the minds of the proud though defeated Basutos, who slipped away in hundreds, upon the expiry of their contracts, for a spell of meditation in their kraals. Basutos form a high proportion of the Premier mine's labour force and they constitute an efficient high-spirited type of worker, unfortunately contributing little to the Rand supply.

The subdivision of duties in the mine is chiefly a tribal matter. The loading of trucks, for instance, is the special sphere of the Basutos, while the Shangaans do most of the drilling and haulage work. There are 11,000 natives at present working in the mine: 5500 on each shift of 11½ hours. Of these, roughly 2100 per shift are drilling on the main terraces, 700 in the development-cuts, and 600 moiling the lumps for the loading boys, of whom there are over 1300 per shift engaged on contract at 4d. per truck. The haulages call for over 400 boys per shift, including those on the sprags. These busy thousands, lined along the terraces and central cuts, or following the constant streams of trucks to and from the haulages, present a picture of concentrated human activity without parallel anywhere in the mining world. The thought naturally arises that, in place of this mass of manual labourers, we should see, in the year 1912, machine-drills and steam shovels. The drills may soon be introduced, but the shovels have been tried and declared to be unfit to compete with the contract coloured labour. Mining conditions would require modification to suit the shovels, which will, perhaps, be reconsidered when other difficulties in the mine have been straightened out and when labour stringency again emphasizes the urgency of replacement.

The terraces in the Premier are 50 ft. deep. Faces are carried as steeply as possible. The development-cuts are at first opened out in 7-ft. benches. Jumper holes are generally charged with 3 sticks of 40% dynamite, specially made for the mine by the Modderfontein works, with a diameter of 1 inch and a length of 8 inches. At each blast, one ton of this explosive is used, equivalent to a monthly cost of £6000 to £7000, or only 1½d. per load. All the fuses, cut in 6-ft. lengths, are capped on surface with 6 B detonators. Blasting is per-

formed twice upon each shift: at 12 and 5.30, day and night. The actual period of detonation, from the first to the last shot, continues for 70 or 80 seconds. The rapidity with which the natives, not concerned in the actual work of blasting, return to their places after their climb out of the mine, bears testimony to the effectiveness of the contract system under which the most critical work is undertaken. It is probable that the Government Mining Regulations, with regard to the counting of the shots, is not strictly observed.

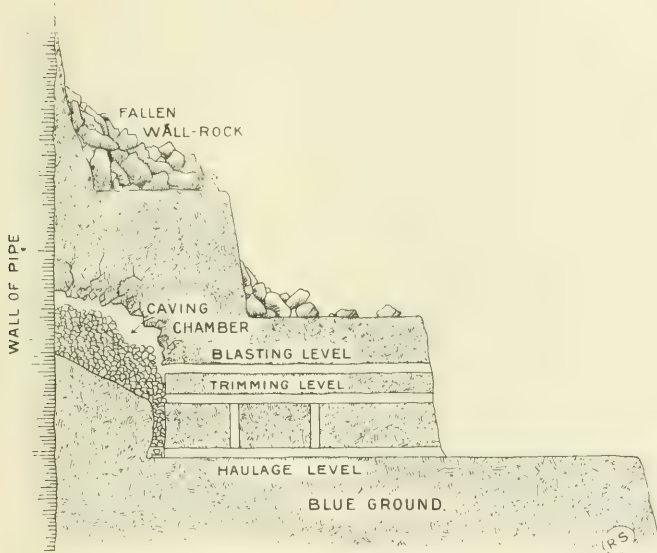
For the organization and supervision of work in the mine, 170 men are employed on the two shifts. Below the general manager and assistant general manager (Messrs. William and Donald McHardy), the staff exclusively concerned with underground operations includes the mine manager (Mr. Howes) and two assistants, 4 shift-bosses, 2 foremen-blasters, 6 sectional blasters, 60 blasters or gangers, 12 charge-men, 60 overseers, 8 tally clerks, 4 main onsets, and 2 mine clerks, for the two shifts.

Before leaving the mine, it may be well to consider the working problems to be faced in course of time, when open-cut working alone will not be capable of providing adequate faces and when the requirements of safety demand the introduction of underground methods. When this period will come cannot be foreseen with any confidence. The mine has yet to enter upon a long and indefinite term of open-working, under improved conditions, with the 'floating reef' removed and the haulages extended through the new tunnel. The dominating factor will be the strength of the vertical walls of the diamond pipe. William McHardy has had a lifelong experience of diamond mining, and has had practical knowledge, vividly fixed in memory by the responsibilities of early mine management, of the dangers and difficulties of deep open-working in the old Central mine, Kimberley, before the consolidation of De Beers. He would feel little tempted—even if Government officials had nothing to say on the matter—to leave the gradual transition to a dangerously advanced stage. The present average depth of the open workings is 170 ft. and at the current speed of production a further 100 ft. of average depth will be made every three years. Diamond pipes generally diminish in size from surface downward. The possibility of wall convergence at greater depth in the Premier, however, is a factor that cannot be taken into account until direct evidence is provided. Even with the security of estimate practicable and the safety with

which conditions in the blue-ground can be foreseen years in advance, there is complete uncertainty as to the maximum height of pipe-wall it will be possible to leave standing above the open workings. This sandstone shell, which will appear like the empty husk of a gigantic stilton, will be a source of great danger for small slips, even before extensive falls of rock occur. Although it must be many years before these troubles become acute, a

caving chamber to an indefinite height and to obtain the full possible advantage from the natural disintegration of the ground. The scheme will be best understood by reference to the section published herewith. No scale is given, as the illustration does little more than demonstrate the principle. The dimensions of the caving area can only be determined empirically.

The caving-chamber will be carried around



PROPOSED SCHEME OF OPERATION.

scheme has already been evolved by William McHardy, by which a change to underground mining can be made gradually without the necessity for sinking shafts in the country-rock, as at Kimberley. In the caving system proposed, a new departure in mining practice will be made. At present it is only on paper. Mr. McHardy is not prepared to claim a successful solution of his mining problems until practice has demonstrated his beliefs, and doubts have been removed by wide experiment. At Kimberley, the caving system is followed between levels 40 ft. apart, overhand stoping being practised from the broken ground. In the Premier mine, it is proposed to carry the

the outside of the deposit, near the rim-rock, and will be opened up from a series of blasting-tunnels, running radially from the open-workings of the mine. Below the blasting level by which the caving-chamber is served for breaking, it is intended to drive a 'trimming' level, to enable the chute to be kept clear of obstructive blocks of ground. Initially, the caving-chamber will be a slope inclined upward from the blasting-level toward the pipe-walls, from which chamber the broken ground will run to the chute. This chamber will at first be heightened by slicing, as at Kimberley. Mr. McHardy believes that natural disintegration of the hanging will subsequently provide the necessary sup-

ply of ground. The kimberlite constituting the Premier blue-ground is full of small cracks and fissures, and abundant slickensides indicate a settling action within the pipe. An exploration tunnel driven, some years ago, from the rock shaft at a depth of 360 ft., proved the rapid disintegrating qualities of the opened ground. How rapidly the falling of the chamber-roof will occur, whether this system of natural shrinkage-stopping will provide ground at sufficient speed, or whether natural agencies will require to be assisted by blasting, must be tested on a working scale. The system can conveniently be introduced at an early stage before the critical necessity for underground mining arises, and in this manner all risk of expensive failure will be avoided. The proposal holds out sufficient promise of economy to justify a wide range of experiment. If successful there will be a lack of drilling and blasting costs to balance the increased expenses of development, handling, and supervision. There will undoubtedly be a great deal of blasting or moiling to be done on the trimming level at the top of the chutes, in which, again, there is likely to be some choking of wet ground, as at Kimberley. The condition of the caved ground and the speed of caving will dominate costs. The vital urgency of keeping expenses at a small figure has been previously mentioned.

The last analysis of expenditure published by the company showed the following items:

Mining and tramming.....	1s. 2½d.	per load washed
Sorting and washing.....	4½d.	" " "
Compound expenses.....	2½d.	" " "
General expenses and motive power.....	3½d.	" " "
	2s. 1d.	

The average cost per load hauled, including waste, was only 1s. 11d. per load of 16 cu. ft., and this figure covered a period when the rate of production was 30% less than at the present time. Since the report, however, there has been no reduction in costs, and the carats produced per 'boy' have fallen, due, in part, to the greater number of 'boys' employed on development work in the cuts and in the new incline-tunnel.

Since 1903, four independent treatment plants have been erected at the Premier, each one involving mechanical changes reflective of increased difficulties in diamond recovery, until the constant conditions in the normal blue-ground were reached. Each new plant, moreover, has been of increasing capacity. The first two gears, now abandoned, were simple washing-pan plants erected in 1903 and 1904, respectively, when the ground was com-

paratively soft and friable. No. 1 gear, consisting of 3 pans, and No. 2 gear, of 8 pans, served their purpose well and carried the company successfully through the early stages of mining in the yellow-ground, sweetened by surface concentration, which yielded for the first three years from 61 to 129 carats per 100 loads. To meet the conditions of a lower yield per load and a lower value per carat, and to satisfy the obvious requirements of the mine for operation on a big scale, without employing floors of several thousand acres for the natural disintegration of the blue-ground, a direct-crushing plant of 20,000 loads daily capacity was erected at a dominating point to the northwest of the mine. The site is admirable in its relation to the shape of the pipe and to the best available area for the dumping of tailing, where the ground slopes away to Beynesport. This, No. 3, gear cost over £300,000, and commenced operations at the close of 1905. Early in 1907, before the industrial upheaval in America that played havoc with the diamond market, it was decided to more than duplicate the mine's producing capacity by the erection of a 'pulsator' or jig-plant (No. 4) adjoining the No. 3 pan-plant. This gear was gradually put in commission at the beginning of 1909.

Summarizing, the Premier treatment plants may be shown as follows:

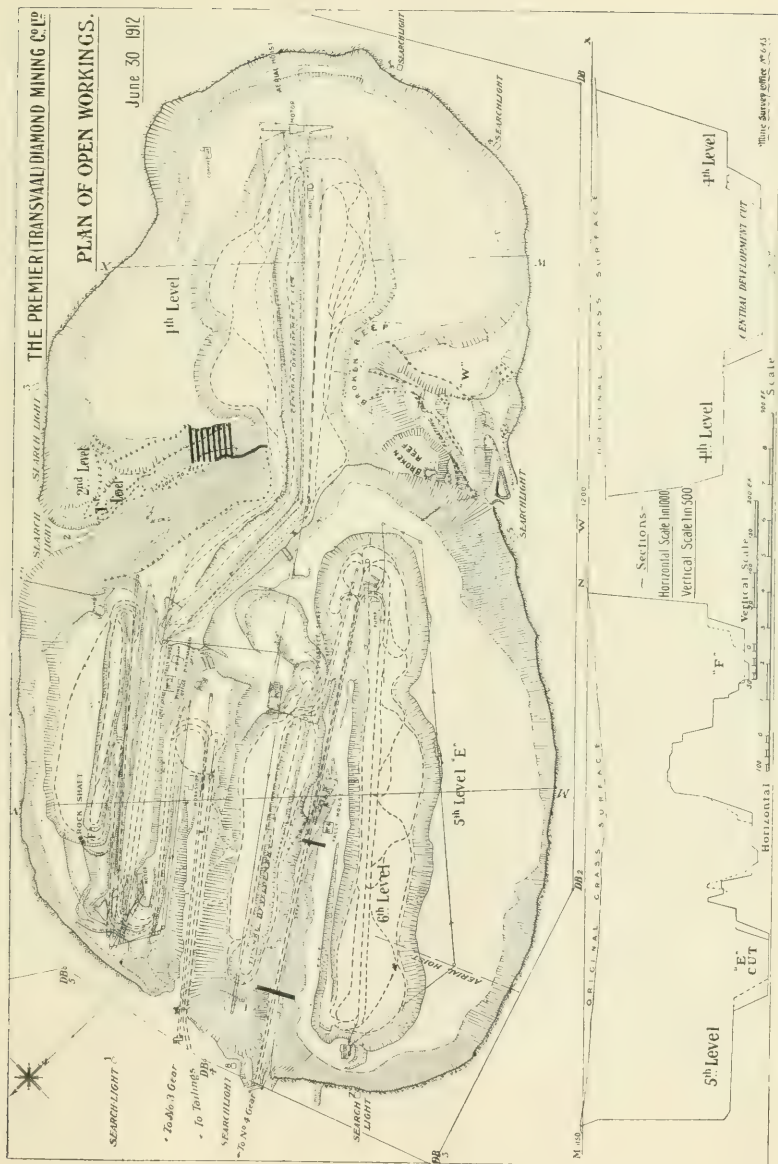
NO. 1 GEAR (abandoned). Three washing pans, commencing work in April 1903.

NO. 2 GEAR (abandoned). Eight pans, working in January 1904.

NO. 3 GEAR. Ten gyratory breakers, ten sets of 4-ft. corrugated rolls, ten sets of smooth 6-ft. rolls, and forty 14-ft. diam. pans. Capacity 20,000 loads per day. Working in November 1905.

NO. 4 GEAR. Fourteen gyratory breakers, 14 sets of corrugated rolls, 14 sets of smooth rolls, 56 first-treatment and 56 second-treatment pulsators, and 14 secondary pulsators for enriching the concentrate. Capacity 28,000 loads per day. Portion of plant working in May 1909.

The product from the two latter plants joins at the tube-mill and wash-up pulsator-house. Before noting in detail the working methods at these two plants, it may be observed that the essential difference lies in the substitution of pulsators in No. 4, for the pans in No. 3. This replacement obviates the necessity for maintaining the fairly thick 'puddle' or sludge in the pans, without which efficient concentration cannot be performed and which does not form naturally upon the addition of clear water



to the crushed unweathered blue-ground. 'Puddling' at No. 3 gear is today helped by sliming material drawn from dumps at the old, No. 1 and 2, washing-plants.

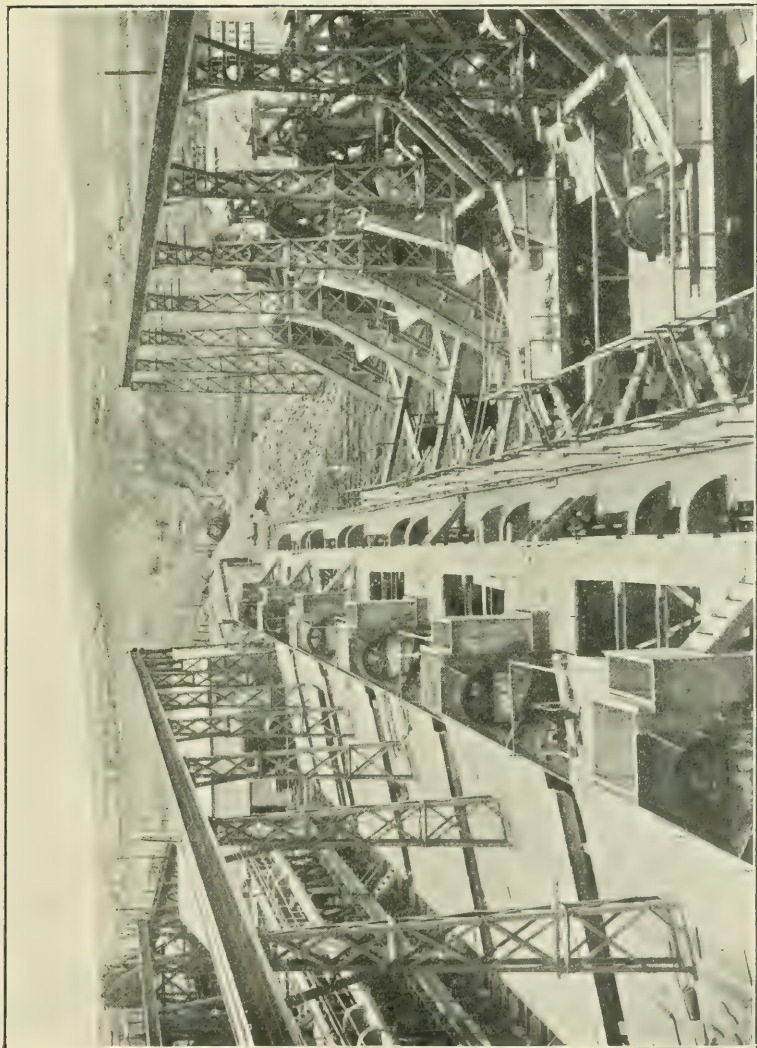
No. 3 gear is composed of five similar independent units. The 20 cu. ft. trucks, having been tallied in the mine for the payment of contract natives and again by automatic register upon the main incline, reach the disengaging point on the tipping-floor at the rate of 1000 per hour. Running by gravity past the five grizzlies and hoppers serving the plant, the trucks are successively discharged at each by a native on the levers controlling the tipping-bars from one central point. Unless accidentally jammed or otherwise checked, the trucks travel past the sprags to an automatic righting-bar (3 in. steel tubing) and re-engage on the endless haulage for return to the distributing points in the mine. Taking one of the five units as an example: the oversize from the grizzly, set at $2\frac{1}{2}$ in., passes through a Y-shaped hopper into two Hadfield size T Heclon gyratory breakers, the product of which joins the grizzly fine and is fed into two sets of 4 ft. corrugated rolls $2\frac{1}{2}$ ft. wide. The upper rolls are set at $1\frac{1}{4}$ in. aperture and the lower at $\frac{3}{4}$ in. The tendency is for the faces to lose efficiency by wearing unevenly, peripheral grooves forming about the middle of the shells, while remaining comparatively unworn nearer the rims. The crushed ground then falls to the boot of a 5-ft. bucket-elevator, which raises it to a distributing point over the four top washing-pans. Water is added, through a $1\frac{1}{2}$ in. pipe, below the rolls. There are eight 14 ft. pans in each of the five units (four over four). Each pair, top and bottom, is fitted with a common vertical shaft for operating the revolving arms, which carry the wedge-shaped teeth employed to drive, by their spiral action, the heavy deposit to the outer rim. The lighter product flows to the inner rim of the annular space, 4 feet in radial width, where it discharges for further treatment. Serving each pair of top pans, there is a set of 6 ft. smooth rolls for final reduction, set to $\frac{3}{16}$ in., before delivery to the lower pans, from below which the tailing is raised in a perforated bucket-elevator, giving a dewatered product for the dump-haulage.

The heavy deposit from the pans falls to scraper-conveyors, delivering to washing-trommels, where the slime is removed by a hot-water spray. Thence the deposit is transferred by belt-conveyor to the storage-tanks serving the tube-mills and wash-up pulsator-plant.

No. 4 gear, composed of 7 units each of a daily capacity of 4000 loads, is similar to No. 3 as far as the double set of 4 ft. corrugated rolls, at which point practice is divergent. To each unit of 2 gyratory breakers and corrugated rolls, there are 8 first-treatment pulsators of cast-iron, provided with $1\frac{1}{4}$ in. apertures. There are three riffle-bars giving four compartments 6 in. deep. 'Lagging' or bedding of punchings from $\frac{1}{4}$ in. plates is used. The concentrate or heavy deposit from these 8 boxes is delivered by elevators and scraper-conveyors to a ninth re-treatment pulsator. The pulsations in the boxes are effected through 24 in. pipes connecting the jigs with the plunger-boxes, in which the plungers make 120 two-inch strokes per minute. The main launder, serving the plunger-boxes, is fed by a centrifugal pump with suction in the settling-dams beyond the final elevators. The 'tail' or overflow from the first-treatment pulsators passes over punched $\frac{1}{8}$ in. screening, drawing off most of the water and slime, onto one set of 6 ft. smooth re-treatment rolls, of which there are two sets to each unit or 14 to the 56 first-treatment pulsators. In the original plant, the overflow passed through a series of spitzkasten, but this system of separating the water and slime from the diamond product was found less successful than simple screening, and was abandoned.

It may be observed that the system of crushing finally adopted in the No. 3 plant was employed, without modification, in the No. 4 plant, after ample experience of the scheme had been obtained. Although wide experimenting has not been attempted in this direction, it appears that corrugated and smooth rolls are without serious opposition in diamond-mining practice at present. A new departure was made in the design of the Voorspoed Company's plant in the Orange Free State, wherein the direct-treated ground was reduced for the top washing-pans by means of 9 ft. grinding-pans, with 1 in. screening. Eight of these machines served eight 14 ft. washing-pans, which were followed by 4 secondary grinding-pans, set to $\frac{1}{2}$ in., feeding the lower 8 washing-pans. It is my belief that this alteration of standard methods was subsequently regretted, though I am unable to give figures in evidence of poorer efficiency.

At the Premier No. 4 gear, the smooth rolls reduce to $\frac{3}{16}$ in. and the product is raised in bucket-elevators to the second-treatment pulsators, which have $\frac{3}{4}$ in. mesh and below which there is no dewatering screen. The overflow passes to the settling-dams, from which per-



No. 1. PULSATOR PLANT, showing position relative to the mine, in background.

forated bucket-elevators remove the waste material for discharge upon the dump. The tramping of the tailing is effected by means of endless-rope haulage, which encircles the great dumps now spreading into the valleys without elevation of tracks above the level of the elevator-discharge. The 'jockeys' are fixed at the middle of the truck-carriage, so that the trucks can be tipped, by hand, at any desired point, and automatically righted without being disengaged from the rope. There is a saving of labour in this continuous system, which has proved highly economical. Nevertheless, spills are more common and inconvenient in their results than with hand-tramping along the tipping-face.

From the two plants, which yield a concentrate representing 1% of the ground washed, the deposit is carried by belt-conveyors to a storage-tank, whence is drawn a regular feed for the tube-mill plant. There are five tube-mills, of which three or four are employed in further reducing the pan or the pulsator concentrate. The tubes, rotated at 20 r.p.m., are half-filled with pebbles of local quartzite and with concentrate feed, and are given an open-end discharge, allowing much freer escape of crushed material than through the usual trunnion aperture. A comparatively slow speed of rotation is adopted to induce vigorous attrition without violent impact, such as is liable to break the diamonds. The discharge from the tube-mills is passed through a double 10-mesh cylindrical screen, rotated by a chain-drive from the tube-mills. In the tube-mills much of the ilmenite (the 'carbons' of the diamond miner) and pyrite is slimed away. The discharge is then transferred by belts and bucket-elevators to the top of the wash-up pulsator plant, where the final classification is performed. This plant is of four units, each comprising 6 sizing-screens, 6 pulsators, and 3 grease tables (vanners). The apertures of the screens comprise the following range: $\frac{3}{8}$, $\frac{5}{8}$, $\frac{1}{4}$, $\frac{1}{8}$, $\frac{3}{16}$, $\frac{1}{16}$ in. The oversize from the top is passed through a jig of $1\frac{1}{4}$ in. aperture, yielding a concentrate that, at present, goes direct to the hand-sorting table. The five other pulsators have apertures of $\frac{3}{8}$, $\frac{1}{8}$, $\frac{1}{4}$, and $\frac{3}{16}$ in. There is one grease-table to serve the two coarse jigs, one to the two medium and one to the fine jig. The bottom bed used in these wash-up pulsators are pellets of an aluminium-copper alloy. In the application of the process, whereby commercial advantage is taken of the well-known affinity of diamonds for grease, a great improvement has been effected upon former methods by the introduction of true vanners, with automatic feed.

The vanner-belts are run very slowly (only 5 or 6 revolutions per hour) and the thick grease, given a thicker consistency in summer by the addition of paraffin wax, is fed on to the belt by means of a perforated cylinder (6 holes per linear inch) fixed under the frame. Near the head of the belt is the feed-roller for the concentrate, the water-jets, and then the scraper, whereby the grease, adhering diamonds, and heaviest concentrate are removed for separation in an electrolytic melting pot. The rich concentrate is then dried and passed over a magnetic separator, which eliminates iron chips and solid ilmenite ('carbons'). The non-magnetic concentrate goes to a final jig, from which the overflow returns to the circuit for re-grinding in the tube mills. Further work is then in the hands of the diamond sorters, who are, unfortunately, obliged, in the case of the Premier, to handle a large quantity of poor stuff, mineralogically determinable as diamonds, though barely worthy of commercial recognition. It is characteristic of the mine, however, to reveal a wide range of quality; moreover, the average value, with which we are industrially concerned, has shown a satisfactory improvement in the more buoyant market of the last few months.

Finally, a word on the personal side of the Premier management, not in superfluous eulogy, but in tribute to that solidarity of control, in head office and at the mine, which makes for steady progress and consistent adherence to clear technical aims. The company's successful disposal of the great quantity of 'cleavage' occurring in the mine-run, without wrecking the market for bort of this description, is a feature of its operations no less remarkable than the company's successful methods of production. At the commencement of operations, a strong management was introduced. In the last ten years, there has been no vital change and there are no premonitory symptoms of any change within the next. The board of directors apparently has little faith in "shooting generals to encourage the rest," and, by its unwavering support, gives the technical heads that stability of position necessary for the establishment of discipline, loyalty, and co-operation. Like De Beers Consolidated, which has given a lead in many directions, the Premier Company has not yet shown a liking for the practice of conducting miscellaneous experiments in mine management on a working scale.

The fine photographs illustrating this article were taken by Mr. P. Mitchell.

PRÉCIS OF TECHNOLOGY

Photolyse.—During the last two years or so much has been heard of the process for softening water by passing it over aluminium sheets. Gaston Jacquier has explained the action as being due to the effect of light. He now describes in the *South African Mining Journal* for September 14 a process founded on the same principle for precipitating gold and silver from clean-up solutions. The plant consists of wooden vats having a removable lining of aluminium; in them are suspended sheets of aluminium fixed to a wooden frame at the top. The solution, after being diluted with hot water, is poured into the vats through a strainer which effects some aeration. The aluminium sheets are set at right angles to the magnetic needle and are exposed to sunlight. After 24 hours exposure, all the gold and silver contained in the solution is precipitated upon the aluminium. The frames are then removed and the precious metal scraped. Subsequently the sulphate of zinc or copper will be decomposed, and the metal be deposited on the aluminium. It is to be noted as a matter of prime importance in connection with the process that the aluminium is not affected in any way and does not lose in weight. Photo-chemical effects are applied in several industries, but not hitherto to metallurgy. Mr. Jacquier's process will therefore be watched with unusual interest. It is noteworthy that the chemical action of light is brought forward as an explanation of some of the effect in the process for obtaining nitric acid from coke-oven gases, recorded in 'Current Literature.'

Decomposition of Sulphates.—The September *Bulletin* of the American Institute of Mining Engineers contains the paper read by H. O. Hofman and W. Wanjukow at the meeting held in February last, detailing the results of their investigations into the dissociation of metallic sulphates into base and acid at high temperatures. Many chemists have published the results of researches in connection with this subject, under varying conditions, and their figures vary accordingly. The authors' experiments were conducted on a small laboratory scale, the heat being supplied and also measured electrically, in an apparatus open at both ends, with a current of dry air passing through. The ordinary crystalline sulphates of commerce were used, and the points of dehydration were observed as well as the dissociation of the sulphur radicle. The paper is one of great importance, and is of considerable length. It is not possible to give more than a few of the general results within the limits of our available space.

Ferrousulphate, $\text{FeSO}_4 + 7 \text{H}_2\text{O}$, on heating, loses 3 molecules of water at 21°C , and 3 more at 80° ; at 130° a physical transformation takes place, the colour changing from white to grey without loss of weight; oxidation starts at 167° and continues to 455° , when the formation of Fe_2O_3 , 2 SO_3 is completed, and at the same time the remaining molecule of water is expelled. The dissociation of Fe_2O_3 , 2 SO_3 begins at 492° and is finished from 555° to 560° .

Aluminium sulphate, $\text{Al}_2(\text{SO}_4)_3 + 16 \text{H}_2\text{O}$, loses 3 molecules of water at 51°C , 3 at 82° , 3 at 97° , 3 at 109° , 3 at 180° , and the last one at 316° . The dissociation of the SO_3 begins at 590° , becomes marked at 639° , and is completed at 690° .

Lead sulphate, PbSO_4 , begins to decompose at 195° , but progresses slowly; at 705° the basic salt 6 PbO , 5 SO_3 is formed; this salt undergoes transformation at 847° , begins to decompose at 888° , to sinter at 896° , and to fuse at 910° ; dissociation starts at 950° , accompanied by volatilization of PbO .

Copper sulphate, $\text{CuSO}_4 + 5 \text{H}_2\text{O}$, loses 2 molecules of water at 29° to 30° , and 2 more between 93° and 99° ; the final molecule is expelled at 155° . The anhydrous sulphate is partly converted at 341° into 8 CuO , 3 SO_3 ; at 653° , 2 CuO , SO_3 is formed; at 704° dissociation into CuO is started, becomes pronounced at 736° , and practically complete at 787° .

Zinc sulphate, $\text{ZnSO}_4 + 7 \text{H}_2\text{O}$, loses one molecule of water at 25°C , 4 at 28° , one at 115° , and the last at 225° . Decomposition starts at 702° with the formation of 3 ZnO , 2 SO_3 , which in turn is dissociated at 755° .

The authors give particulars also of the behaviour of sulphates of bismuth, silver, nickel, cobalt, magnesium, cadmium, and barium.

Prospective Lives of Witwatersrand Mines.—The *South African Mining Journal* for September 21 publishes an estimate of the expected lives of gold mines of the Witwatersrand. The table is prefaced by a suitable warning as to the reliability of all estimates of this character, and the various factors which may make for inaccuracy. These need not be recapitulated here. Suffice it to say that the figures are obtained by multiplying the presumed tonnage per claim by the number of claims, and dividing by the present rate of exhaustion.

Central Mining and Investment Group:

	Years
Bantjes Consolidated	44
City Deep (65,000,000 tons per month)	37
Crown Mines	42
Durban Roodepoort Deep	18
Ferreira Deep	12-15
Geldenhuys Deep	16
Modderfontein B	68
New Modderfontein (1,000,000 tons per year)	22
Nourse Mines	25
Robinson	6
Rose Deep	12
Village Deep	23

Consolidated Gold Fields of South Africa:

Knights Deep	15
Robinson Deep	14
Simmer & Jack	12

Farrar:

East Rand Proprietary Mines	30
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General Mining and Finance Corporation:

Aurora West	25
Cinderella Cons. (1,200,000 tons per year)	42
Meyer & Charlton	18
New Goch	17
Van Ryn	20

Johannesburg Consolidated Investment Co.:

Consolidated Langlaagte	30
Ginsberg	5
Glencairn	9
New Primrose	6
New Unified	9

Anglo-French:

New Kleinfontein	25
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S. Neumann and Co.:

Consolidated Main Reef	50
Main Reef West	45
Wit Deep	13
Wolhuter	10

A. Goerz and Co.:

May Consolidated	1-2
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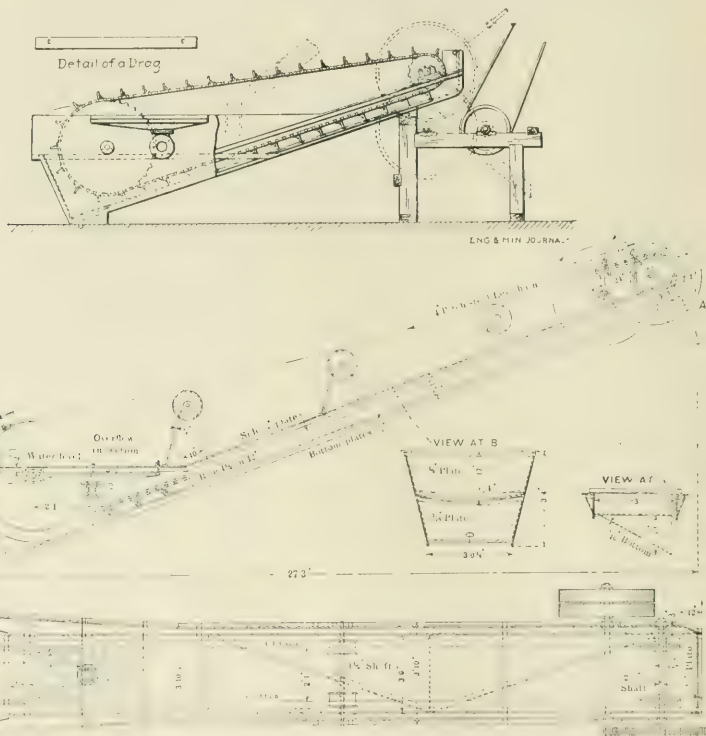
Robinson:

Langlaagte Estate	26
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Drag-Classifier.—In the *Engineering and Mining Journal* for September 28 Frederic MacCoy, chief engineer of the Esperanza company, describes the drag-classifier which is much in vogue in the El Oro district of Mexico. The classifier is the joint invention of H. A. Guess, manager of the Federal Lead Co., Missouri, and Charles Hoyle, manager of the Esperanza Co., and is used in the El Oro district for separating the slime from the sand before tube-milling. At Esperanza two batteries of these classifiers are used. The upper battery takes the stamp-mill product and

and presenting an overflow-edge, a conveyor in said box encircling the overflow-pan in a vertical plane and comprising an endless series of transverse scrapers extending across said box and adapted to engage the bottom, said series extending along said bottom to above the liquid level."

As will be seen by the illustration, the sand and slime enter the classifier through the feed launder; the lighter slime overflows into the slime-discharge pan and from there out through the slime-discharge pipe. The sand, being heavier, settles to the bottom



separates the flocculent slime from the quartz sand, and sends the sand to the tube-mill plant for regrinding, and the slime to the upper Pachucas. The lower battery is working on the tailing dump which was built up in the days before the tube-mill plant was installed. This tailing dump contains a greater proportion of sand, as much of the original slime has been washed away.

The essential features of the classifier, to quote the description contained in the patent specification, are: "The combination of a settling-box having an inclined bottom extending above the overflow level, an extended overflow pan in said box spaced from the ends thereof

of the box, where it is caught by the scrapers and elevated above the overflow level and discharged over the top of the inclined bed of the classifier.

Various ratios of classification are possible, by altering the speed of the drag-chain, spacing of the drags, inclination of the classifier, varying height of overflow slime-pan, sprinkling of the sand as it is elevated above the overflow, etc.

Various materials have been used at Esperanza for the scraper bars, such as slotted trommel plates, solid iron bars, and angle irons, but the most satisfactory material has been found to be ordinary wooden slats, as they keep ground down to conformity to the bot-

tom, and are inexpensive to replace when worn out. The metal bars develop a tendency to arch somewhat from continued use, and thereafter do not engage the bottom as well as do the wooden bars.

At the mill of the Mexico Mines of El Oro, the classifier is used as a combined classifier and oversize-return on the tube-mills. A classifier is placed alongside each tube-mill and receives the combined discharge from the stamp-batteries and the tube-mills. The slime is cut out, and the oversize from both sources is elevated by the drags to a point high enough above the feed end of the tube-mill to flow in by gravity.

The classifier has been installed in all of the mills in the El Oro district, with slight variations in dimensions, etc., from the original as built at Esperanza. As indicative of the work which the classifier does, a résumé of tests under working conditions is given in the accompanying table. Samples were taken every 30 minutes.

TESTS OF CLASSIFIER AT ESPERANZA MILL.

Test Number	1	2	3
Tons treated.....	11,056	4653	17,035
Number of classifiers	3	2	2
Screen Test on Feed	%	%	%
+ 40 mesh	7.4	5.3	1.9
+ 60 mesh	9.8	10.1	8.5
+ 80 mesh	8.3	10.0	9.2
+ 100 mesh	1.4	1.9	1.2
+ 150 mesh	21.4	23.0	23.9
+ 200 mesh	1.6	0.8	0.4
- 200 mesh	50.1	48.9	54.9
Screen Test on Sand Product			
+ 40 mesh	15.1	15.3	9.1
+ 60 mesh	20.2	24.2	25.2
+ 80 mesh	15.9	18.4	20.6
+ 100 mesh	2.6	2.8	2.4
+ 150 mesh	31.3	30.3	32.4
+ 200 mesh	1.9	0.7	0.4
- 200 mesh	13.0	8.6	9.9
Screen Test of Slime Product			
+ 100 mesh	0.5	0.8	0.9
+ 150 mesh	5.7	6.9	8.8
+ 200 mesh	1.0	0.5	0.4
- 200 mesh	92.8	91.8	89.8

Air-Cushion Stamp in Australia.—In the *Monthly Journal* of the Chamber of Mines of Western Australia, W. R. Degenhardt describes the mill recently erected at the Mountain Queen gold mine, near Southern Cross. This mill consists of two Holman air-cushion stamps, which reduce the ore to 12-mesh, and grinding pans, which further comminute the ore to a size suitable for amalgamation and subsequent cyanide treatment. The article contains a description of the principle of the Holman stamp, and working drawings are appended. Results obtained since the commencement of operations in January of this year up to the end of July are given in detail. It should not be necessary for us to summarize that part of the paper dealing with the principle of the air-cushion stamp, but as there are many misconceptions as to the nature of the machine, we may take this opportunity of describing its method. The 'pneumatic' element consists of an air-cushion interposed between the driving mechanism and the stamp. The power is supplied by an overhead revolving shaft, through cranks and connecting rods, to a vertically-oscillating cylinder. The stamp-stem passes through this cylinder and carries a piston which fits the cylinder. In the walls of the cylinder are bored rows of holes. As the piston moves up and down, the air above or below the holes is trapped and acts as a cushion. Thus the jar of rapid driving is

minimized. To allow for the wear of shoe and die, it is necessary to have two rows of holes above the central position of the piston and two below. With new shoes and dies the upper of the two sets are in use and the others plugged, and subsequently when wear has taken place, the lower ones are opened and the upper ones plugged.

The ore at the Mountain Queen is partly soft oxidized material and partly hard ferruginous sandstone. The policy is to feed the two sorts concurrently. No preliminary crushing plant is necessary, for the ore breaks naturally, and any oversize on the grizzly over the bins is broken by hand. The water is salt, and 6 tons is used to 1 ton of ore. It was found inadvisable to work on the soft ore alone because the feed could not be properly regulated, thus necessitating a slower rate of operation. With a suitable mixture of the two classes, 135 drops may be made per minute, instead of only 123 with the soft ore. At the 135 rate, the two heads together consume 44 to 50 h.p. The record of capacity is given in detail in the article, and it is shown that, at the higher rate of running with mixed ore, the daily capacity of the battery is 140 to 170 tons, or 70 to 85 tons for each stamp.

As regards wear and tear, two new stems had to be provided after 180 days, the first ones having broken close to the head. The consumption of steel in the shoes and dies was 11,114 lb. during seven months, while 24,892 tons of ore was milled, or 0.447 lb. per ton milled. The amount of water used was 1200 gal. per ton of ore. The author estimates that the work done by these two stamps is equal to that done by 15 ordinary stamps weighing 1250 lb. each, though he says that no exact comparison can be made until the same ore is used for the comparative trials. His figures for relative cost of stamps, buildings, and driving mechanism are decidedly in favour of the air-cushion stamp.

Fluor-spar in England.—The commercial literature relating to the production of fluor-spar in England and its destination is scarce, so that the information contained in Ernest F. Burchard's chapter on fluor-spar in 'Mineral Resources of the United States' for 1911, is of interest. Practically all the fluor-spar imported into the United States comes from England. Only since 1903 has the output of the United Kingdom exceeded 10,000 tons annually, and there has been, except in 1908, a steadily increasing annual production of spar to 1910, which is the latest year for which statistics are available. According to the official report in 1910 there was 61,621 long tons produced, valued at £20,678, or 68.9d. per ton, as compared with 42,483 tons, valued at £16,029, produced in 1909. Of the 1910 output, 19,410 tons was produced from mines in Derbyshire, including large quantities produced from mine dumps, and 18,133 tons from quarries in the same county, and 24,078 tons were produced from mines and mine dumps in Durham. Comparing the 1910 output with the imports of fluor-spar into the United States, and considering that the latter are derived almost wholly from England, it is evident that nearly 62% of the British production was shipped to the United States in 1910. Minor quantities are exported to continental Europe and to Canada and from 17 to 25% of the output is used at home. A large proportion of the fluor-spar produced in England is obtained by screening from waste dumps of old lead mines. Opinions differ as to the ratio between the quantities of fluor-spar that are mined or quarried and those that are recovered from old workings, but it has been estimated by persons familiar with conditions in England that from 30 to 35% of the ore produced is recovered from old dumps,

and the remainder is actually mined. According to another authority, more than 90% of the gravel spar shipped is obtained from waste piles resulting from long abandoned lead mines. The same authority considers that this source of supply is unlimited, that there are millions of tons of material scattered over a large area, some of it well situated for transportation and some at too great a distance to be hauled economically by carts or motor trucks. An authority of equal standing believes that the supply at present available will last a comparatively short time, but probably this estimate refers specifically to that portion of the supply which is conveniently situated for transportation and which may therefore be readily and profitably handled. This gravel spar carries 50 to 80% of calcium fluoride.

Estimates have been obtained from operators as to the cost of producing fluor-spar in England. It is reported that spar mined by sinking shafts and driving levels costs from 12s. 6d. per ton upward, on the ground, and the cost of haulage to the railway is from one to four shillings per ton. Only the highest grade of spar, carrying 95% or more of calcium fluoride, is worth mining in this manner, and only a small proportion of the output consists of this grade. Spar mined from open quarries is estimated to cost about 10s. per ton, delivered on railroad cars. Many of these quarries are adjacent to railways. The grade of spar thus obtained carries generally between 80 and 90% of calcium fluoride. The spar taken from waste heaps costs at least 2s. 6d. per ton less than spar that is mined, so that the cost would perhaps approximate 7s. 6d. to 8s. per ton loaded into railway cars. The output of one large firm is transported from mine dumps to the railway by trains of cars drawn by traction engines. In view of the close correspondence between the estimated cost of production of spar from mine waste and the values of the output given by the British official reports, it is evident that the greater part of the fluor-spar produced at present in England is obtained from mine dumps. The deductions contained in this paper must be taken with some caution. For one thing, the law does not require a return of production that comes from anywhere nearer than the surface than 20ft. Second, the value of the output in Great Britain is probably understated for reasons well appreciated.

Fume Filters.—At the September meeting of the International Congress of Applied Chemistry held at New York, Anton Eilers, of the American Smelting & Refining Co., presented a paper on 'Bag-filtration Plants.' He described two typical modern plants, one at the Murray lead smelter, Utah, and the other at the Omaha works in Nebraska. At the former works the charge consists of low-grade lead ore averaging 10 to 12%, mixed with gold and silver ores. Most of the gold and silver and some of the lead carried away by the gases settles in the flues, but much lead fume cannot be caught there, so in 1907 a bag-house was erected. Mr. Eilers describes in detail the construction and operation of this plant. From the economic standpoint the bag-house is only profitable because it eliminates law suits. During 4 years and 8 months, from July 1907 to February 1912, the total charge smelted was 1,666,857 tons, estimated to contain 10% lead, 0.15 oz. gold, and 14 oz. silver per ton. The fume recovered amounted to 6929 tons, averaging 32% lead, 0.018 oz. gold and 2.15 oz. silver per ton. The cost of operating the plant was \$76,853 and the smelting charge, at \$10 per ton, was \$69,290, making a total cost of \$145,143. The value of the metals recovered was \$152,690, so that the profit was only \$6547. These figures do not include amortization or interest on capital involved, so that actually there is a large loss.

The saving in the expense of law-suits was however incalculable.

At the Omaha plant, bag-houses are used in connection with the blast-furnaces and with acid and basic converters. The gases from the converters are led first into a steel flue and then to the bag-house. The converters work on matte assaying 45% copper, 23% lead, and 18% sulphur, and produce about 45 tons of blister copper per day. During February 1911, 1667 tons of blister copper was produced, 100 tons (dry) of sulphate of lead fume were taken from the flue, 130 tons from the fan, and 385 tons from the bag-house. At the Omaha blast furnaces, there are two bag-houses. During 2½ years the charge carried 31,254 tons of lead, and 2623 tons of fume averaging 50% lead was recovered. The collection and treatment of the fume yielded a handsome profit. *The Mining & Scientific Press* for October 7 contains a full abstract of Mr. Eilers' paper.

Mining Methods at Nacozari.—The September *Bulletin* of the American Institute of Mining Engineers contains an article by D. C. Livingston on the methods of mining at the Pilares de Nacozari copper mine in Sonora, Mexico, situated close to the boundary of Arizona. The mine belongs to the Moctezuma Copper Co., and the copper concentrate is shipped to the smelter of the Copper Queen mine at Douglas, to be treated in conjunction with the ores from Bisbee. In the *Mining and Scientific Press* for March 19, 1910, Courtenay de Kalb described the method of mining, but alterations have been made since, so we give details from Mr. Livingston's paper.

The ore deposit is in cross-sectional plan in the form of an ellipse having a major axis 2000 ft. long and a minor axis 600 ft. long. The ore is of low-grade. The mine is opened by two 3-compartment shafts situated one at each end of the ellipse, and by an adit about a mile long which taps the deposit at a point about 600 ft. below the collar of the shafts. This adit is large enough to allow narrow-gauge, 25-ton cars to load from the mine-chutes. The daily output is between 1500 and 2000 tons. The levels are 100 ft. apart. The general plan is to use every alternate level as a stoping base, the intermediate levels being used for development, ventilation, and the distribution of waste to the stopes that are being filled. At the present time practically all the ore is being mined above the adit, which is known as the '700,' and at the present rate of output there is an ore-supply of 10 or 12 years above this level. The shaft at the north end has been sunk to the 1000-ft. level, and some work has been done on this level, as well as on the 800 and 900-ft. levels.

Owing to the scarcity of timber, it has been necessary to adopt mining methods that would eliminate its use as much as possible. The nature of the rock is such that while it is not hard to drill or blast, it stands without timber remarkably well in most parts of the mine. This characteristic of the rock has also prevented the using of the caving and top-slicing methods. Thus some system of underground stoping had to be devised, and the following two methods are used: (1) the old method, Fig. 1, which is room-and-pillar with waste-filling as the work progresses; (2) the new method, Fig. 2, which is shrinkage with waste-filling after all of the ore has been extracted.

With the room-and-pillar method the mine-plan is laid off into pillar-lines at right angles to the strike of the ore and placed 50 ft. apart, dividing it into alternate stopes and pillars. A main working drift is run approximately parallel to the strike, and cross-cuts are turned off every 100 ft. in the pillars. From these

cross-cuts, right-angle headings are turned off, and every 50 ft. run to the centre of the stope, and from these the sill-floor is cut out to the limits of the ore and to the pillar-lines, making the stope 50 ft. wide. The roof, where necessary, is supported by props or cribs, and a 6-ft. cut is then taken upward with stoping-drills, the blasted ore being drawn off immediately, and filling run in from the level above through winzes to within 4 or 5 ft. of the roof. The short drifts from the cross-cuts are timbered through the filling, and cribbed chutes and man-ways are carried up from the ends of these. In a stope 150 ft. long, there would be three of these chutes and man-ways. Probably the difficulties of removing these pillars without losing a large amount of ore by mining with waste, led to the adoption of the new method.

With the shrinkage method, designed by C. A. Smith, the use of timber is almost entirely eliminated, as not even timbered chutes are used. Cross-cuts are turned off from the main haulage-drift every 50 ft. parallel to

The machines are set up on the broken ore, enough being drawn out through the shovel-ways to keep a working-clearance. The stope is continued up in this manner to the next stoping-level. This work was started last summer, but it is evident that the main drifts will have to be timbered where the stopes cross them in order to keep the broken ore off the track, and cribbed man-ways built up through the broken ore at these points; but aside from this, with the exception of an occasional prop, no timber is used at all. There would be no absolute necessity for man-ways through the broken ore, as the stope can be entered by means of the winze from the level above.

As regards the comparative costs of the two systems, everything points to a considerable saving in the shrinkage over the room-and-pillar system. This should be the case after the sill floor has been opened

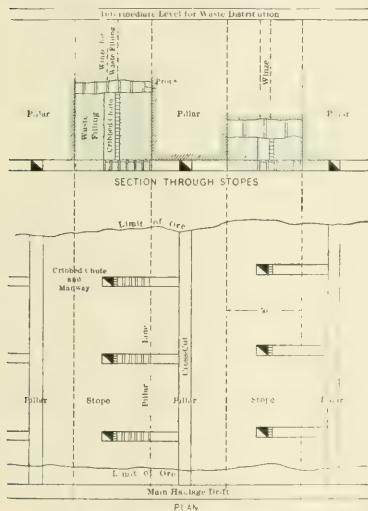


FIG. 1. Room-and-Pillar System.

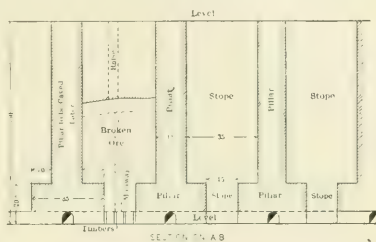


FIG. 2. Shrinkage System.

MINING METHODS AT NACUZARI.

the pillar lines, and extending to the limits of the ore. The next step is driving what are called the 'stopes,' which are breasts 15 ft. wide and the height of an ordinary drift. These are driven parallel to the cross-cuts, and midway between them, and are carried to the limit of the ore. From the cross-cuts, shovel-ways are turned off at right angles at intervals of from 20 to 25 ft., and are driven to connect with the stopes. Turn-sheets are placed at the mouths of the shovel-ways. The ground is now ready to commence underhand stoping. The stopes are carried up the same width (15 ft.) with stoping-drills to a height of 20 ft. above the floor, and are then widened 10 ft. on each side making them 35 ft. in width, with 15ft. pillars in between.

up, because, in the shrinkage system, there is no rock handled in the stopes until the ore is drawn out; whereas, in the room-and-pillar system both the ore and waste-filling have to be handled in the stopes in wheelbarrows.

Corrugated Ships.—Though not one of the specialties of this Magazine, we refer from time to time to the construction of ships whenever the subject affords matter of general interest to engineers. This may be said of the ship with the corrugated hull, so we quote herewith from the article in *Engineering* for October 18, reporting the lecture by G. S. MacIlwaine at the Royal United Service Institution. The Ericsson design of ship has the shell-plating arranged with longitudinal corrugations along the sides between the

water-line and the turn of the bilge. The first, the *Monitoria*, was built in Sunderland three years ago; three more have been launched, and two others are in course of construction. A seventh is being built in Norway. Captain MacIlwaine made several voyages in the boats and investigated the claims. His conclusions are that the following advantages are secured: (1) increased strength of hull; (2) higher propeller efficiency, consequent on superior stream-lines due to the corrugations; and (3) that the vibration is greatly reduced, and the steadiness and stability increased.

The *Hyltonia*, the second ship launched, was described in detail by the author. The length is 279 ft., beam 39 ft. 10 in., draught 18 ft., and when carrying 3340 tons deadweight she displaces 4614 tons. There are two corrugations. The distance from the top of the upper to the bottom of the lower is 13 ft. 3 in., and the corrugations project 22 in., tapering gradually fore and aft. The space between the corrugations seems to act as a conduit pipe supplying the screw, which in its turn appears to play the part of a pump drawing an unbroken body of water along the ship's sides wherein to work. That is to say, the water is less disturbed, and the blades of the propeller can always be seen while revolving below the surface. The slip of the propeller is less than 2% as compared with a 13% slip on a similar ship with plain plates. The average revolutions were 58 per minute, the indicated horse-power 630, the speed 9 knots, and the coal consumption 10.8 tons per day. For the same duty with the ship having plain plates, the horse-power was 700 to 750, and the daily coal consumption 12 tons.

Estimating Tonnage of Sand.—The August *Journal of the Chemical, Metallurgical, and Mining Society of South Africa* contains a useful paper by Percy T. Morrisby, the manager of the cyanide department at Knight's, describing many details of practice at his plant. One of the items was the measure used for estimating the tonnage of dry sand. This measure consists of a light open frame made of wooden standards 3 by 3 in., braced together with horizontal battens $4\frac{1}{2}$ by $1\frac{1}{2}$ in. The bottom and sides are lined with galvanized wire screens, cut to exact size so as to lie perfectly flat against the woodwork. The inside dimensions are length 7 ft., breadth 2 ft., and depth 1 ft., giving a cubical content of 14 cu. ft. Holes $1\frac{1}{2}$ in. diam. are bored through the wooden frame at intervals so as to reduce the resistance of passing waves in the pulp and to ensure an even collection of sand. A number of measures are placed in the collector vats, across the diameter and from top to bottom, so as to sample a complete vertical section. The vats measure 42 ft. diam. by 7 ft. 6 in. deep and are fitted with Butters & Mein distributors. The screens are allowed to remain buried in the sand until they are uncovered during the transfer of the sand to the leaching vats. They are then removed and the sand levelled by a straight edge. The content of each is weighed, and afterward two samples taken for moisture. Thus the dry weight per cubic foot can be obtained.

Sun-Power.—The *Engineer* for October 11 contains a description of the plant erected by Frank Shuman, of Philadelphia, at Meadi, a suburb of Cairo, Egypt, for the purpose of raising steam by the heat of the sun. We have several times referred to this method of obtaining power, and have shown that the prospects of concentrating the sun's heat by mirrors are not encouraging, for several reasons (1) the great extent of mirror required, (2) the necessity for following the sun, (3) the limits imposed by night, cloud, and the varying height of the sun above the horizon. Nevertheless we

appreciate the efforts of those who pursue the subject in a practical manner. At Meadi, the mirrors are made of silvered-glass plates, mounted in such a way as to form a long reflector having approximately a parabolic section. The steam-generator is a thin long vessel mounted in the line of focus of the parabola. There are five reflectors, each 204 ft. long, and the steam-generators are of the same length, 14 inches wide and the internal thickness only $\frac{3}{8}$ in. The generators are made of zinc, and are covered with a black paint of high heat-absorbing quality. At the upper edge the generators are enlarged into steam-collectors, 4 in. diameter. The generators and collectors have a fall of 6 inches throughout their length. The collectors are connected to the main steam-pipe at the upper end, and the feed-water is introduced at the lower end. The reflectors and generators are carried on light steel cradles, the outer circumference of which is in the form of a segment of a circle. The cradles are moved by rack and pinion, so that the mirrors shall follow the sun, the power being supplied by the pulleys from the engine itself. It has been found best to work with a pressure slightly below that of the atmosphere, corresponding to a boiling point of 200°F. A special engine has been designed for utilizing this quality of steam. A difficulty not previously recorded is due to the dust which settles on everything, especially in Egypt. It has been necessary to devise means for tipping the reflectors and cleansing them by means of jets of water with a hose-pipe. The results obtained by this installation have not as yet been published.

CURRENT LITERATURE.

Dust-Prevention.—The *Iron & Coal Trades Review* for October 11 describes the new device introduced by the Flottmann Engineering Company of Cardiff for catching the dust made by hammer-drills. It should be remembered that the new Coal Mine Act of Great Britain provides that a machine-drill working in ganister or other silicious constituents of coal measures must have some accessory appliance for preventing the escape of dust into the air.

Hoisting at the Franklin Mine.—At the August meeting of the Lake Superior Mining Institute, R. H. Corbet described the hoist at the Franklin copper mine, where compressed air and steam are used conjointly, the air being compressed by the descending skip, to be used afterward in combination with steam for raising the loaded skip.

Sand-Filling.—At the October meeting of the Institution of Mining and Metallurgy, R. E. Sawyer presented a paper describing the system of sand-filling used at the Cinderella mine on the Rand.

Santa Gertrudis.—In the *Engineering and Mining Journal* for September 21, W. G. Matteson describes the method of mining adopted at the Santa Gertrudis mine, Pachuca, Mexico.

Concentration by Flotation.—At the October meeting of the Institution of Mining and Metallurgy, a paper by J. W. Ashcroft was presented, describing the results obtained by the Minerals Separation process at the Kyloe copper mine, New South Wales.

Gold-Dredging.—In the *Mining and Scientific Press* for September 14, John H. Miles describes the gold-dredging operations in the Boise basin, Idaho.

Screen Analysis at Cananea. The *Mining and Scientific Press* for September 14 contains an article by A. T. Tye, on comparative methods of screen analysis at the mill of the Cananea Copper Co. This should be read in conjunction with the article in the

Magazine in April last, describing the flow of the ore through the mill.

Gold-Dredging.—In the *Mining and Scientific Press* for September 28, Charles Janin reviews the dredging operations on the Seward peninsula, Alaska.

Gitsham Gold-Extracting Process.—The *Mining and Engineering Review* (Melbourne) for September 5 describes the process invented by J. Gitsham. The novelty consists of the use of an acid solution formed by the reaction of sulphuric acid on potassium cyanide, liberating free hydrocyanic acid.

Iron in Cyanide Plant.—The August *Journal* of the Chemical, Metallurgical, and Mining Society of South Africa contains a paper by A. Mc A. Johnston, on the action in the cyanide process of the iron that is introduced into the pulp through the wear of drills, shoes and dies, liners, etc.

Lead Salts in Cyanide Treatment.—In the *Engineering and Mining Journal* for September 28, J. E. Clennell discusses the action of lead compounds in cyanide solutions, in improving extraction and eliminating cyanicides.

Cyanidation in Nevada.—In the *Engineering and Mining Journal* for October 12, Whitman Symmes describes the Mexican mill on the Comstock lode, Nevada, where the ore is all-slimed and cyanided.

Cyanidation in Carolina.—In the *Engineering and Mining Journal* for September 14, Percy E. Barbour describes the modern cyanide plant at the Iola gold mine in North Carolina.

Collection of Gold in Smelting.—At the October meeting of the Institution of Mining and Metallurgy, G. C. McMurtry presented a paper describing a method of collecting gold in speiss in the smelting of antimonial copper concentrates.

Besshi Copper Mine, Japan.—In the *Mining and Scientific Press* for September 21, H. Foster Bain describes the Besshi copper mine in Japan and the Shisaki smelter.

Blende Roasting.—The *Engineering and Mining Journal* for October 12 and 19 contains a translation by O. H. Hahn of W. Hommel's article published in *Metallurgie* on the roasting of blende ores.

Assay of Silver-Cobalt Ores.—*Metallurgical and Chemical Engineering* for October reprints the paper by J. O. Handy read before the International Congress of Applied Chemistry on the methods of sampling and assaying silver ores containing cobalt, nickel, and arsenic, adopted by the Pennsylvania Smelting Co., and the Pittsburg Testing Laboratory.

Estimation of Arsenic and Antimony.—In the *Engineering and Mining Journal* for October 12, Harley E. Hooper describes methods of estimating arsenic and antimony in concentrate, matte, and slag.

Estimation of Tin.—The *Mining and Engineering World* (Chicago) for September 21 reprints a paper by W. W. Patrick and G. C. Wilsnack, read before the American Chemical Society, describing a volumetric method of determining tin, specially intended for investigation of alloys.

Analysis of Pig Iron.—*Metallurgical and Chemical Engineering* for October reprints in full the paper read before the International Congress of Applied Chemistry by J. M. Camp on the methods used at the plants of the United States Steel Corporation for the commercial sampling and analysis of pig iron.

Dolores Ore Deposit.—In *Economic Geology* for August, J. E. Spurr, G. H. Garrey, and C. N. Fenner give a study of the contact-metamorphic ore deposit at Dolores, San Luis Potosi, Mexico, and the first-named elaborates a theory of ore deposition based upon the case.

Classification of Igneous Rocks.—The *Journal of Geology* (Chicago) for September contains a paper bringing up to date the 'Quantitative System of Classification of Igneous Rocks,' by Whitman Cross, J. P. Iddings, L. V. Pirsson, and H. S. Washington. The system was first promulgated in 1902.

Ancient Theories of Ore Deposition.—The *Mining and Scientific Press* for October 5 publishes an extract from H. C. & L. H. Hoover's forthcoming translation of Agricola's 'De Re Metallica,' dealing with theories of ore deposition prior to the 17th century.

Graphite in Ceylon.—*Economic Geology* for August contains a paper by E. S. Bastin describing the graphite deposits of Ceylon. Large quantities are exported from Ceylon to the United States.

Granulating Molten Slag.—The *Iron & Coal Trades Review* for October 18 describes the Jantzen process for granulating molten slag by means of a blast of air, the product being specially suitable for the manufacture of cement.

Nitric Acid from Coke-Oven Gases.—The *Times Engineering Supplement* for October 8 describes the Hauser process, used at the De Wendel colliery in Westfalia, for producing nitric acid by exploding a mixture of coke-oven gases and oxygen.

Copies of the original papers and articles mentioned under 'Précis of Technology' and 'Current Literature' can be obtained on application to The Mining Magazine.

BOOKS REVIEWED

MODERN MINE VALUATION. By M. Howard Burnham. Cloth, octavo, 160 pages, illustrated. London: Charles Griffin & Co. Price 10s. 6d. For sale by The Mining Magazine.

This handy volume contains the matter published during 1911 in *The Mining Magazine*, together with additional material, mainly elaborations of the points made in the earlier articles. The author has failed to acknowledge the previous publication of the major portion of his book, not to mention the friendly editing of his manuscript and the assistance cordially given to him by the editor of *The Mining Magazine*. Hence it may be here recorded. Meanwhile, the result of it all is a book that conveys much useful information and suggestive thought. Prompted originally by his unsatisfactory experience in the Santa Gertrudis examination, the author has elaborated the basic principles underlying mine valuation, until he has covered a wide range of investigation and elaborated an interesting series of conclusions. No consulting engineer in practice should fail to read what Mr. Burnham has written; he will find, if he does so, that while he may not find himself in agreement with all of the author's theses, he will at least have come nearer to understanding a problem fundamental to mining finance. The book is well printed, adequately illustrated, and conveniently indexed. T.A.R.

THE BUSINESS OF MINING. By Arthur J. Hoskin. Cloth, octavo, 226 pages, illustrated. Philadelphia and London: J. B. Lippincott Company. Price 6s. For sale by The Mining Magazine.

The sub-title of this book is: 'A brief non-technical exposition of the principles involved in the profitable operation of mines.' The author was at one time professor of mining in the Colorado School of Mines, and is now western editor of *Mines and Minerals*. His object in writing this book is to show the doubting public that metal mining is a legitimate industry if usual business precautions are observed, and not the unvar-

sal swindle as alleged by many superior people. In his efforts to disabuse the public of this erroneous idea and to impress on directors and engineers the necessity of conducting operations on sound principles, Mr. Hoskin has our entire sympathy. He pleads for the employment of young men of scientific training as prospectors and for the engagement of the services of geologists of high standing for the purpose of making examinations. He is a keen advocate of precision in the use of technical terms. He defines the words ore, mines, mining, etc., and describes at length the operations connected with prospecting, development, stoping, and treatment of ore. In other chapters he discusses the economies of mine management, investment in mining shares, promotion and organization of companies, United States mining law, and other cognate subjects. The principles enunciated are all sound, and the average layman will be a vastly wiser man after a thoughtful perusal of the book.

We do not however agree with all the views expressed by the author, but these are mostly in connection with points of comparatively small importance. His definition of 'mining' is too narrow; he says that the driving of an adit or a cross-cut and the sinking of a shaft elsewhere than in the ore are not 'mining.' Also we object to the word 'placering' as a substitute for 'placer mining.' His information is often faulty, and in consequence errors of fact disfigure the pages. For instance he gives the following jumble: "The famous Sudbury nickel-silver orebodies were disclosed when making a railroad." His references to the Alaska-Treadwell and the Mount Morgan mines with regard to open-cut working are some years out of date. He talks of tin coming from "the Malay Peninsula and the Straits of the East Indies. Since the main source of our tin is British territory, the markets are controlled by London." Banca and Billiton are not British, nor is Bolivia, and, as the London Metal Exchange is aware, the control is not exactly centred in London. His explanation of the origin of the word 'reef' as applied on the Rand will not hold water; he says the deposits were called reefs because "they were undoubtedly ancient coast beaches or sea placers." In writing of the increasing production of gold he mentions that the world's production took a sudden drop in 1900, but does not give the reason, which of course was the temporary closing of the mines on the Rand during the war. "Our own day has seen the subjugation of the Boer." 'Subjugation' is not quite the right word. "It is possible and quite probable that the gold used in the building and furnishing of King Solomon's temple came from the vicinity of the present city of Johannesburg." Researches show that an ancient civilization knew the gold, copper, and tin deposits of Africa as far south as the latitude of Pretoria, and exhausted the surface showings, but knew nothing of the Witwatersrand or of the diamond fields. Errors such as these may be easily eliminated in a succeeding edition. E.W.

THE CIVILIZATION OF ANCIENT MEXICO. By Lewis Spence. Cloth, pocket size, 122 pages, with illustrations. Cambridge and London: Cambridge University Press. Price 1s. For sale by *The Mining Magazine*.

Mexico occupies a conspicuous position in the mining engineers' picture of the world at the present time, and all who wish to thoroughly understand the condition of things must seek the aid of history. A year or more ago we published two thoughtful articles by Theo. F. van Wagenen on Mexico, in which he discussed the ethnological conditions. Naturally he was not able within the small compass of his articles to delve deeply

into history and tradition. Mr. Spence's little book covers this subject admirably, and places before his readers in a concise manner the main points of what is known of the inhabitants of Mexico before the Spanish Conquest. A useful bibliography is appended.

INDEX OF MINING ENGINEERING LITERATURE. VOL. II. By Walter R. Crane. Cloth, octavo, 450 pages. New York: John Wiley & Sons; London: Chapman & Hall. Price 21s. For sale by *The Mining Magazine*.

We have several times given our opinions as to the value of technical indexes; briefly our view is that the value depends on the individuality of the compiler. So many people undertake this class of work that have not the necessary knowledge of the subjects in hand, and the searcher is therefore without the desirable services of an expert guide. Mr. Crane's compilation differs in this way from all the others. He is a thoroughly well-informed man, as might be expected, seeing that he is a professor of mining, and the author of 'Ore Mining Methods.' His remark in the preface that "the work has been the result of the *unaided* labour of the author" is of prime importance (the italic is ours), for it shows that the selection of the articles indexed has been done with judgment. We have also to record our opinion that this new volume is of far higher quality than Volume I. When we reviewed the latter three years ago, we had to draw attention to the vagueness of many entries. Undoubtedly the work connected with the first volume was more difficult and trying, because it covered the early volumes of journals and transactions, and involved special effort and research. On the other hand, Volume II contains references to the current literature, and the records could be kept week by week in the ordinary course of the author's studies. Thus he has had time to look through each article and weigh its value. No attempt has been made to cover the whole field of technical literature; the total number of publications receiving notice is only seventeen. The bulk of these are American, and the remainder consist of the Transactions of the South African Society, the Australasian Institute, the two English Societies, and *The Mining Magazine*. In future volumes, we hope he will tabulate the full names of the various societies and journals as an explanation of the initials, and differentiate between the defunct and current Mining Magazine. The book is admirably indexed, and an inquirer after knowledge is greatly helped thereby. It only remains for us to say that we greatly appreciate Mr. Crane's work, and that we expect the volume will be continuously useful to us in our researches. E.W.

THE MINING WORLD INDEX OF CURRENT LITERATURE. By Carpel L. Breger. Cloth, octavo, 350 pages. Chicago: *The Mining and Engineering World*. Price 10s 6d. For sale by *The Mining Magazine*.

In the review of Professor Crane's book we have given our opinion of indexes. *The Mining and Engineering World* attempts to cover too much ground, and there is no indication of special capacity on the part of the compiler.

THE PHYSICS AND CHEMISTRY OF MINING. By T. H. Byrom. Small octavo, 200 pages, illustrated. London: Crosby Lockwood & Son. Price 3s 6d. For sale by *The Mining Magazine*.

This is the second edition of a well known elementary class-book for the use of coal-mining students. The author was for many years lecturer on chemistry at the Wigan Technical College in Lancashire, and is now chief chemist for the Wigan Coal & Iron Company.

COMPANY REPORTS

Caucasus Copper.—We have on previous occasions given the earlier history of this company, which operates a large low-grade copper property at Dzansul, in the Russian Caucasus. After years of difficulty, the company appears now to be emerging into a period of prosperity. The report covering the year ended May 31 last (Russian style) shows that the production was equivalent to 3030 metric tons of refined copper. The sales brought an income of £256,195, and the working cost was £166,019. Out of the profit, £70,044 was paid as debenture interest, and £23,779 was allowed for depreciation. James Colquhoun, formerly manager of the Arizona Copper company, is the chairman of the board of directors, and spends a large part of his time at the mine. At the meeting of shareholders he gave many details of the operations. The concentration

5% second debentures, and £745,900 non-convertible 5% second debentures. The position of the ordinary shares is therefore greatly improved. It will be remembered that the company has the advantage of the higher price of copper ruling in Russia.

Taquah Mining & Exploration.—As has been recorded in these columns on previous occasions, this company was originally formed in 1888 to acquire gold-mining properties on the Gold Coast, West Africa, and has passed through many reorganizations. As at present constituted, the company operates the Taquah mine, and holds the preponderating interest in the Abosso, particulars of which are given in the succeeding paragraph. The control is now with the Oceana Consolidated, which provided the necessary funds at the last reorganization. The report now issued covers the year ended June 30 last, and shows that milling was resumed in July 1911 with 20 stamps,



plant is at present treating 500 tons of ore daily. A third unit of 250 tons capacity is being erected and should be at work early in 1913, while the order has been given for further plant that will bring the output to 1000 tons. A new aerial ropeway is being built, having a capacity of 2000 tons per day. The methods of mining have been revised. In the first place the overburden consisting of loose soil varying in thickness from 10 to 100 ft. is now removed by hydraulic mining; second, the ore is mined from the great open-cut by the 'funnel' or 'mill-hole' system, thus eliminating all shovelling. A new reverberatory furnace has been built, measuring 89 by 19 ft., and the waste gases are used for steam-raising. As regards ore reserve, the estimate seven years ago was 3,600,000 tons, and since then the developments have about kept pace with the extraction. The finances have recently been rearranged. The whole of the outstanding profit-certificates, amounting to £500,000, together with £299,900 in options, have been surrendered and cancelled. The £379,000 6% second debentures have been scaled down to 5%; and £440,000 loans have been satisfied by 5% second debentures. The issued capital of the company consists now of £500,000 ordinary shares, and there are £45,280 5% first debentures, £500,000 convertible

to which 10 more were added in March last. During the year, 43,041 tons of ore was treated, yielding 29,804 oz. gold, or 13.83 dwt. per ton. The value of the gold produced was £128,427 or 58s. 9d. per ton. The slime is not being treated at present, and on June 30, 10,069 tons had been stored, estimated to contain 2 dwt. per ton. A plant for its treatment is being erected. The mining cost was £62,195, general expenses and interest on loans £9277, charge for development redemption £15,634, depreciation £19,191, amount written off for shaft extensions £4331, leaving a profit of £13,452. During the year £46,366 has been spent on account account, the money being provided partly from profits and partly by loan. The loan account for money advanced by the Oceana company stands at £128,045 in the balance-sheet; of this £24,045 has been repaid since the end of the financial year. As the capital expenditure is now completed, it is expected that profits will soon liquidate the rest of the debt. J. S. Newbery, the manager, reports that on June 30 the ore reserve was estimated at 168,551 tons averaging 62s. 3d. per ton. The 12th level, the lowest, is being developed, and the lode has already been proved to continue to this depth, with the same average content as in the levels above.

Abosso Gold.—This company is now a subsidiary of the Taquah Mining & Exploration Co., particulars of which are given in the above paragraph. The report for the year ended June 30 last shows that 89,322 tons of ore was sent to the mill, with an average estimated content of 40s. 11d. per ton. The recovery by amalgamation and cyanide was worth £164,782, or 36s. 10d. per ton. The reorganization of the metallurgical plant is still proceeding; 20 new stamps have been erected and an additional 30 are in process of installation. A third Cobbe pan has been provided. On June 30 the proved ore amounted to 229,128 tons averaging 40s. 6d. per ton, being an increase of 15,131 tons during the year; in addition 69,000 tons averaging 39s. per ton is reported as partly developed ore. The income during the year was £164,782; the mining expenses were £92,685, development redemption £23,034, administration expenses £3505, depreciation £21,277, written-off shaft extensions £4466, taxes £3329, leaving a profit of £16,683 which was carried forward.

Globe & Phoenix.—This company, operating the gold mine in Rhodesia, has issued the usual half-yearly interim report, covering the six months ended June 30. During this time, 33,824 tons of ore was raised and sent to the mill, and the production of gold was 57,383 oz. On June 30, the ore reserve was estimated at 179,427 tons, averaging 35 5 dwt. per ton, and on September 30, the figures were reported by cable at 173,383 tons, averaging 34 4 dwt. per ton. Progress has been interrupted by scarcity of labour, and also by the unusual drought. On account of the latter trouble, it was found necessary to suspend work at the accumulated-slime plant, and to defer the starting of the new sand plant. H. A. Piper, the consulting engineer, reports that developments have disclosed further amounts of high-grade ore. The new vertical shaft is being sunk, and on September 7 had reached a depth of 106 ft. During the half-year dividends totalling 3s. 6d. per £1 share have been paid. The latest information is to the effect that the water trouble is being overcome.

Jumbo.—The report issued by this company, owning a gold mine in the Mazoe valley, north of Salisbury, Rhodesia, is gloomy reading, for it shows that the profitable ore has been practically exhausted. Operations were started in 1906, and from then to June 30 last, 196,797 tons of ore had yielded gold worth £454,208, without the shareholders receiving any dividend. The control is with the United Rhodesia Gold Fields, of the Lewis & Marks group, and H. A. Piper and W. F. N. Dudgeon are consulting engineers, acting on behalf of the Consolidated Gold Fields of South Africa. The report for the year ended June 30 states that the 30 stamps crushed 38,210 tons of ore, and by amalgamation and cyanide 14,813 oz. gold was recovered worth £62,994. The working cost at the mine was £52,847, and London expenses absorbed £2931; £12,429 was written off for depreciation, £9552 off the development-redemption account, and £12,694 off the special prospecting account. The net loss for the year was £27,491. In March last the consulting engineers advised that development should be suspended, and at June 30 the reserve was 9690 tons, averaging 9 57 dwt. per ton. There are £11,000 debentures outstanding, and any working profit will have to be devoted to their redemption. The future policy of the company is to be reconsidered shortly.

Glynn's Lydenburg.—This company was formed in 1895 to acquire a gold mine on the Sabie river in the Lydenburg district of the Transvaal. Milling commenced in 1897 with 10 stamps, and profits have been made continuously. The plant now consists of 20

stamps and 1 tube-mill. The control is with the Central Mining group, and G. C. Damant is manager. The report for the year ended July 31 shows that 37,325 tons of ore was mined, estimated to contain 11½ dwt. gold per ton. By amalgamation 6983 oz. was recovered, and by cyanide 13,856 oz., the total being 20,839 oz., or 11½ oz. per ton. The revenue was £87,362, or 47s. 2d. per ton, and the working cost was £42,643, or 23s. per ton. As compared with the previous year, the tonnage was 3455 greater, the yield per ton 1 dwt. less, and the total yield £622 greater. In addition to the working profit there were sundry items of revenue totalling £2714. The sum of £4557 was allocated to taxes, and £42,500 was distributed as dividend, being at the rate of 25%, the same as during the last 6 years. The developments during the past year have disclosed 33,245 tons of ore, of the same average grade as that mined, and on July 31 the total reserve was 69,200 tons.

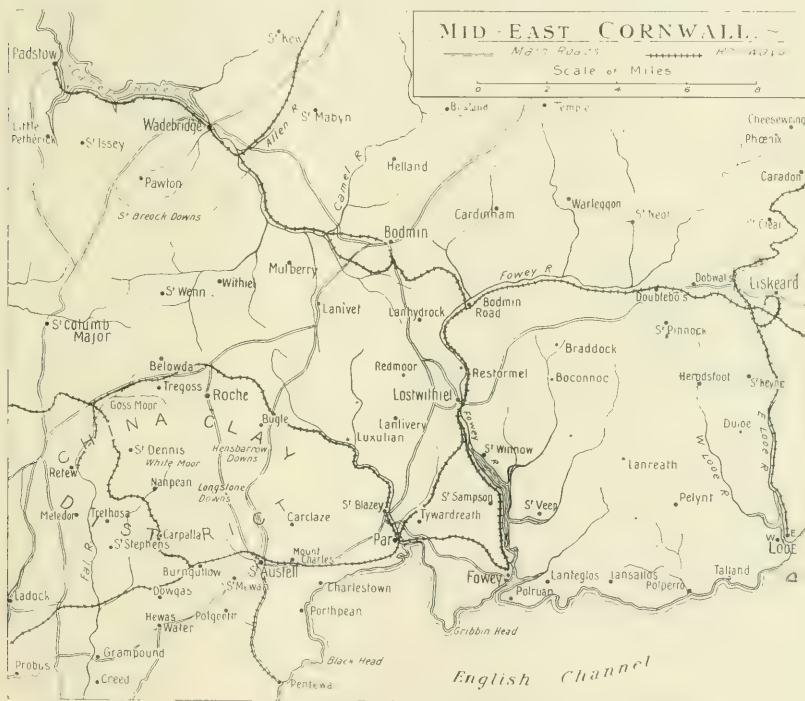
Sheba Gold.—The welcome improvement recorded in the fortunes of this company a year ago has been well maintained, and another period of continuous dividends appears to be within view. The company was originally formed in 1884 to acquire a group of gold properties in the Barberton district of the Transvaal. Dividends were paid during the years 1891 to 1898, and then came a series of disappointing years. In 1904 the company was reconstructed. Three years ago it was decided to alter the method of working the properties, and instead of drawing ore from a great number of mines, attention was concentrated on two. The results were gratifying, for the developments disclosed large orebodies, parts of which were of high content. A year ago the nominal capital was reduced by changing the denomination of the shares from £1 to 5s., and now stands at £269,738. The report for the year ended June 30 shows that 68,865 tons of ore was raised, averaging 12½ dwt. per ton, chiefly from the Zwartkops mine. An average of 65 stamps (out of 120) were in operation, and the yield was 34,980 oz. During the previous year, 49,455 tons yielded 24,016 oz. The income from the sale of gold was £148,074. The cost at the mine was £92,442, and London and other charges £4400. The sum of £3804 was written off for depreciation and mine development, and £4632 was paid as taxes. The dividends, at the rate of 15%, absorbed £40,460. During the year 7603 ft. of development work was done, and the ore reserve increased by 22,750 tons to 127,000 tons on June 30. H. B. White is manager, George C. Fox is consulting engineer, and the control is with Lewis & Marks.

Zaaiplaats Tin.—This company was formed under Transvaal laws in the summer of 1908, to acquire tin deposits in the Waterberg district north of Pretoria. Milling commenced in February 1909 and large profits have been made. The report for the year ended July 31 shows that the mill of 15 stamps crushed 29,330 short tons of ore, from which 1647 short tons of concentrate was recovered averaging 67% metal. The average yield was 3 76% of metallic tin per ton of ore. During the year, the 750-lb. stamps have been replaced by new ones weighing 1500 lb. and additional dressing plant has been erected. Re-treatment of accumulated slime is to commence shortly. Developments at the mine continue to be satisfactory. Although the lodes vary in width and content, very rich patches are found here and there. The vertical depth of the workings is now 450 ft. Extensive areas are still unprospected, as also is an alluvial deposit in the valley below. The ore reserve actually blocked-out is estimated at 24,622 tons, averaging 3 42% metal, not including ore in branch veins. The accumulated

sand and slime awaiting re-treatment amounts to about 60,000 tons. The scanty rainfall has caused some anxiety, but the mine and the Sterk river have supplied sufficient water for the dressing plant so far. Power is generated by suction gas, and is distributed electrically. George H. Furner, the manager, has resigned recently. During the year, the income from the sale of concentrate was £159,680, and the profit was £108,364. Out of this, £90,000 has been distributed as dividend, being at the rate of 150% on the capital £60,000, and £14,397 has been spent in new plant.

of standard works on clay, has reported favourably on the performance of the Gee machine. The capital of the company is £75,000, divided into 65,000 cumulative participating 7% preference shares, and 10,000 ordinary shares. Of these, 20,000 preference shares, all the ordinary shares, and £25,000 cash go to the vendors, and £20,000 is required for working capital.

Kingsdown Tin.—The prospectus of this new company has been advertised in West Country papers. The company has been formed, with a capital of £30,000, for the purpose of acquiring the Kingsdown sett, three miles west of St. Austell and not far distant



Standardized China Clay.—This company has been formed for the purpose of acquiring a china-clay property at Belowda, north of Roche, Cornwall, and to acquire the Gee patents covering the centrifugal process for preparing the clay for market. We described this process in our issue of last March. The combined difficulty and undesirability of seeking a reward for inventive genius by means of licenses and royalties have prompted the promoters of this company to acquire a property, whereby commercial profits may be made and concurrently the advantages of the process demonstrated. The property has been examined by J. Henry Rickard and Joseph Jennings, as engineers; W. Bullock and W. Roberts have examined the clay from the point of view of users; and A. B. Searle, the author

from Dowgas. The property is in practically virgin ground, and the lodes known at the Hewas and Ventonwyn mines on either side have been proved to pass through it. Blackmore & Howard, the consulting engineers, recommend the sinking of a vertical shaft to a depth of 250 ft., and cross-cutting to find the four known parallel lodes. Of the share capital £17,500 is being issued fully paid as purchase price, and £12,500 is being offered for public subscription. J. H. Collins has expressed a favourable opinion of the prospects.

Olga Exploration.—This company was formed in July last by John Taylor & Sons to take over the assets of the Mysore Reefs & Explorers. These assets include shares in the Anantapur and Jibutli companies, operating gold mines in India, and options on the Olga and

Vizzer Creek auriferous gravel properties in Dutch Guiana. An expedition headed by Thomas Bevan has been dispatched to these placers and arrived at Paramaribo in September. The nominal capital is £110,000, divided into 440,000 shares of 5s. each. Of these, 74,980 have been allotted as fully paid, and 86,533 have been allotted credited with 2s. 6d. paid; 1s. has been called up on the latter.

Hutti (Nizam's) Gold Mines.—This company was formed in 1901 to acquire the Hutti gold mine in India, from the Hyderabad Deccan company. Milling commenced in March 1903, and dividends were paid from 1903. The report now issued covers the nine months ended June 30, the odd period being due to a desire to change the end of the financial year from the inconvenient date of September 30. During this period, 17,485 tons of ore was milled, and gold worth £46,386 recovered. The profit was £12,417, out of which £7195 has been written off for depreciation, £712 paid as tax, and £3480 distributed as dividend, being at the rate of 5%.

Since the closing of the accounts, £4000 has been spent on winding engine, boilers, and steel head-gear for the new main shaft. A Butters filter-plant is being provided for the treatment of slime. The developments at the mine, as already reported in our columns, have been eminently satisfactory. The high-grade ore discovered on the 1840-ft. and 1940-ft. levels has been proved on the 2040-ft. level, where the lode varies from 2 ft. 6 in. to 5 ft. in width and from 10 to 20 dwt in content. A winze sunk from the 2040-ft. level is in ore of the same quality. The reserve of ore is estimated at 20,000 tons averaging 15 dwt., and in addition there is a large quantity of ore of lower grade. F. W. Grey and Thomas Morgans are on the board, and J. Douglas Hay is manager.

Stratton's Independence.—The report of this company operating the gold mine at Cripple Creek, Colorado, for the year ended June 30, shows that both the mine and the dump continue to yield profits. It is not necessary to recapitulate the history of this mine, as we have given it on previous occasions. Of late years, operations have been confined to re-treating the dump by the method described by the manager, Philip Argall, in our issue of November, 1911, and to the working of parts of the mine by the company and by tributaries. In 1908 the capital was written down by reducing the shares from £1 to 2s. 6d., and stands at £125,000. The report now issued shows that the output of ore by tributaries was not as great as during the previous year, but that the ore produced by the developments conducted on behalf of the company showed a substantial increase. In all probability the production by tributaries will still further decline, and the yield of low-grade ore on company account will increase. The new vein system, called the 'mill veins,' discovered a year ago, promises to lengthen the life of the company. The output of ore from the Independence mine was 10,455 tons produced by the tributaries, containing gold worth \$304,464, and 4550 tons produced by the company, having a content of \$116,518; in addition 1922 tons containing gold worth \$48,599, was taken by tributaries from the Washington claim, and 1567 tons from the dump containing \$35,735, also by tributaries. The net returns from the sale of the ore amounted to \$377,480, of which \$87,156 was received by the company from its own ore, and \$108,752 from royalties. The company also won 13,019 tons of ore which was treated by the company's plant, containing \$67,887, and yielding a profit of \$20,784. At the company's treatment plant, 99,372 tons of dump-ore as well as the 13,019 tons of mine-ore was treated, yielding 18,833 oz. gold. The profit at the plant was £13,778, the net proceeds from

sale of ore on company's account £17,970, and the company's royalty on tributaries' production was £22,432. The cost at the mine was £14,122, administration expenses were £6954, London expenses £2209, and allowance for depreciation £3505, leaving a profit of £27,465, out of which £25,000 has been distributed as dividend, being at the rate of 20 per cent.

Tomboy Gold Mines.—This company was floated by the Exploration Company in 1899 to purchase a gold mine of that name near Telluride, Colorado. In 1901, on the approaching exhaustion of the mine, the adjoining Argentine property was acquired. A year ago, a further purchase was made with the view of continuing the existence of the company, the Montana claims, forming the southern portion of the Revenue Tunnel's property, being bought for £80,000. We have already published details of this latest deal. The report now issued covers the year ended June 30 last. D. A. Heron, the manager, states that 107,577 tons of ore was milled, of which 21,702 tons came from the Montana and the remainder from the Argentine. The recovery of metals was worth \$954,981, the cost of mining, treatment, etc., was \$504,040, and the profit \$450,941. An increasing proportion of the precious metals is now being recovered in concentrates, of which several are produced, varying in lead, zinc, and iron content. The new concentration plant has been erected under the advice of Gelasio Caetani. The development work at the Argentine group has been suspended during the year, and the available labour devoted to the proving of the Montana, where the results have been most satisfactory, the 21,702 tons sent to the mill averaging \$10 50 in gold and silver, as compared with \$9 25 as estimated as an average when the purchase was made. The reserve at the Argentine group is 340,000 tons, and at the Montana 150,000 tons. The profit and loss account shows a profit of £86,861, and with £51,431 brought forward from the previous year, the available balance of profit is £138,292. Out of this, £82,193 has been written off for the purchase in cash of the Montana group, £6707 has been allowed for depreciation of plant, £4000 has been allocated for income tax, and £31,000 has been paid as dividend, being at the rate of 10 per cent.

Hainault.—The mine belonging to this company is at the northern end of the Kalgoolie goldfield, and has been producing since 1901. The profits have never been great, and the total dividend distributed amounts to 40% on a capital of £150,000. The control is in Glasgow, and Archibald L. Hay is manager. The present metallurgical treatment is a survival of early practice in the district, the plant consisting of stamps, amalgamating pans, concentrators, roasters, and cyanide annex. In the report now published, covering the year ended May 31, it is indicated that a change may be made to dry-crushing and all-roasting. During the year, 63,542 tons of ore was raised and sent to the mill, most of it coming from the 500-ft. and 650-ft. levels. In addition, 4335 tons of accumulated slime was treated. The total yield of gold was worth £78,825. The average assay-value of the tailing was 1 84 dwt. per ton. Seeing that the content of the ore is less than 7 dwt., this loss shows that there is considerable room for improvement. The cost of mining was £29,153, and of extraction £32,269; the allowance for mine development was £12,708, being 4s. per ton of ore raised, and for depreciation £5060. The head-office expenses were £1705. The net loss for the year was £2901. The ore reserve has been maintained, and on May 31 stood at practically the same figure as a year ago, namely, 100,000 tons, averaging 28s. per ton. The developments on the 350 ft. level are favourable

Chillagoe.—This company was formed in Melbourne in 1898 for the purpose of working copper and lead deposits in North Queensland, and to construct a railway from Mareeba. It has also a ramification of interests connected with the smelting of custom ores mined by subsidiary companies and by other producers. No dividend has yet been paid on the ordinary shares. The report for the year ended March 31 shows a serious shrinkage in business, and the fall in the various departments is causing anxiety to the directors. At the Zillmanton mine, after re-opening subsequent to the flooding, the copper ore that was previously deemed profitable was found to be not worth extraction owing presumably to decomposition and leaching,

ing the manufacture of coke, has been proved. The Government has expressed an intention of constructing a railway line to connect the coalfield with Dimbulah.

Tingha Consolidated Tin.—This company was formed in Melbourne in 1906 to work tin gravel properties in the northeast of New South Wales. The capital is £200,000, divided equally into ordinary and 10% preference shares of 10s. each. The only dividend paid so far has been the preference to the end of 1907. A change in the management has recently been made. James Symes, the new manager, is a specialist on centrifugal pumps for raising gravel. He has reorganized the work, closing two plants, and acquiring additional property. The report now issued covers the



The mine was thereupon abandoned. In order to secure a new supply of ore for the smelter, the Einasleigh copper mine farther south was purchased. The output at this mine is now about 3000 tons per month. The Minerals Separation flotation process is to be installed in order to reduce the silica content. At the smelter, 39,906 tons of ore was treated, nearly half coming from the Einasleigh mine, and about the same quantity from the Chillagoe district, mostly from the Mungana mine, while small amounts came from the Forsyth group. The production was 1436 tons of lead bullion containing 1037 oz. gold and 88,541 oz. silver, and 1867 tons of blister copper containing 1248 oz. gold and 109,345 oz. silver. The accounts show a profit on the railway of £45,648, and a loss of £27,446 on the mining and metallurgical operations, leaving a net working profit of £18,202. After £29,228 was paid as debenture interest, £13,367 allowed for depreciation, and £11,600 paid as administration expenses, the loss on the year's operations was £32,590. A more promising feature of the report refers to the Mount Mulligan coalfield, situated 20 miles to the north. The existence of an abundant supply of coal for all purposes, includ-

half-year to July 31, during which time 64 tons of tin concentrate was recovered, selling for £8035, and yielding a profit of £858. Additional water-supply is being provided.

Amalgamated Zinc (De Bavay's).—This company owns the De Bavay flotation patents and treats the zinc tailing from the North, South, and Block 10 mines at Broken Hill. The report for the six months, January to June, shows that 259,452 tons of material was treated, for a yield of 70,496 tons of zinc concentrate averaging 49.1% zinc, 6.2% lead, and 9.3 oz. silver, and 992 tons of lead concentrate assaying 53.2% lead, 17% zinc, and 35.8 oz. silver. The receipts from the sale of concentrate were £245,475, and the treatment expenses and cost of tailing purchased totalled £139,947, leaving a working profit of £106,171. Out of this, £11,704 went as administration expenses and taxes, £25,000 was placed to reserve, £7349 written-off the cost of investigation into new metallurgical processes, and £75,000 distributed as dividend, being 15% on £500,000, the paid-up capital. It should be noted that the income from the sale of concentrate is a complex figure, based on £22 per ton for the current

production of zinc concentrate, and the extra payment at the final settlement for concentrate produced in previous half-years. The directors state that the Imbert process of electric smelting, which their experts examined recently, has not yet proved to be a success, and that experiments in connection with other processes are in hand. We have already recorded the agreement made in July between this company and Minerals Separation for the pooling of Australian royalties.

Scottish Australian Mining.—This company was formed as long ago as 1859 to work a number of properties in New South Wales and Queensland, belonging to the Scottish Australian Investment company. Operations are now chiefly confined to the Lambton and Burwood collieries, near Newcastle, New South Wales. Dividends have been paid practically continuously since 1869. The report for the half-year ended June 30 last shows that the sale of coal totalled 149,493 tons, and would have been greater but for the scarcity of labour. Wages continue to rise and the price of the coal cannot be increased proportionally. The export trade is still hampered by high rates for freight. The company also owns a copper mine at Cadia, New South Wales, which has been leased to a subsidiary company. A new blast-furnace is in course of construction and smelting should be re-commenced shortly. Other property includes an iron ore deposit also let on lease, but nothing is yet being done with it. The income during the half-year from the sale of coal was £67,278, and the net profit was £2474. Adding the balance brought forward from the previous half-year, £5599, the disposable balance was £8073, out of which £3125 has been distributed as dividend, being at the rate of $1\frac{1}{4}\%$ for the six months on the capital £250,000.

Kinta Tin.—This company was formed in London in 1900 to acquire tin-gravel properties in Perak, Malay Peninsula. Osborne & Chappel are the managers. Dividends have been paid with regularity and have increased steadily from 10% in 1902-3 to 30% for 1909-10. During the year ended June 30, however, the production has been slightly restricted, owing partly to the drought, and also to the curtailment of operations pending the provision of a new high-pressure water-supply. The output was 216 tons of black tin as compared with 322 tons the year before. The income was £24,477, or £113 per ton, as compared with £33,774, or £104 per ton. The profit was £16,382, as compared with £23,101. The dividend absorbed £12,000, being at the rate of 20%. As foreshadowed in the report issued a year ago, a new scheme has been adopted in conjunction with the Gopeng companies for bringing a new supply of water to the mines. The company's share of the cost of this installation is estimated at £75,000, which is being raised by the issue of 60,000 new shares at 25s. per share.

Malayan Tin Dredging.—This company was formed in May 1911 to acquire tin-gravel properties situated near Batu Gajah, in the Kinta district, Perak, Federated Malay States. The report on the property was made by Nutter & Pearce, of Ipoh, Perak, and F. W. Payne & Co. are the designers of the dredging plant. A dredge has been built on the spot and was floated on July 23 last. Its dimensions are 150 by 34 ft., and the buckets are of 10 cu. ft. capacity. Gravel pumps have also been provided capable of lifting from a depth of 80 ft. below the surface of the water. It is hoped that the completion of the plant will not be long delayed. Further boring tests have shown that the deposit averages 46 ft. in depth and contains from 1 to 3 lb. black tin per cubic yard. The cost is estimated at $4\frac{1}{2}$ d. per cubic yard. Tests on adjoining property have been

equally promising, and the holdings of the company have been accordingly extended. Leonard Vaughan has been appointed manager.

Sakalava Madagascar Oilfields.—This company has been formed under the laws of the Orange Free State for the purpose of acquiring the prospecting rights over 1500 square miles in the Betsiriry valley, near the west coast of Madagascar, belonging to three companies named in the prospectus. Various experts have reported on these properties, including David Levat, Hans Merensky, H. T. Burls, J. Mc L. Henderson, and Thomas Draper. Mr. Henderson in his report states that in some occurrences, especially those sheltered from the sun, the oil is a thick viscid fluid seeping to the surface, showing between the parting in the sandstone, or exuding from fissures and cracks more or less at right angles to the bedding-planes. The oil is black, though in thin layers it shows a brown tinge. It emits a strong and disagreeable odour which characterizes the dark heavy oils found in some parts of the Western States of America. The capital of the company is £100,000, of which £47,000 is being paid in shares to the vendors and £43,000 is being offered for subscription in South Africa, £10,000 shares being held in reserve.

Rand Klip.—This company belongs to the Anglo-French Exploration group, and was originally formed in 1894, for the purpose of acquiring claims in the far east Rand. After several re-organizations the undertaking was put on its present footing in June 1909. Development of the property started by means of two 5-compartment shafts, but work on the West shaft was suspended in November 1910, when a depth of 555 ft. had been attained. The report for the year ended June 30 shows that sinking has been continued on the East shaft, and that on June 7 the Main Reef series was intersected at a depth of 1804 ft. The deposit at this point carried 2'18 dwt. gold over 54 in., or 2'88 dwt. over 36 in. The rate of sinking was retarded by influx of water and by scarcity of native labour. A main station has been cut and equipped and a suitable pumping plant erected. A cross-cut has been driven to the reef, and drifts each way started. So far, 584 ft. has been driven, and the average content is 4'29 dwt. over a width of 20'88 in. The upper seams in close proximity have not yet been tested. The expenditure during the year was £61,040, leaving a balance in hand of £64,867. J. T. Milligan is manager.

Welgedacht Exploration.—This company was formed in 1899 to acquire property in the far east Rand, containing both gold and coal. A 5-compartment shaft was started in February 1910 to reach the gold deposit, which had been previously proved by bore-holes. Prior to this, the development of the coal deposits had been conducted, with the result that in 1905, the resources were estimated at 15,000,000 tons. Production commenced in 1907, but was not eventually profitable. The report for the year ended June 30 last shows that the sinking of the main shaft for the gold mine was suspended in October 1911, owing to the serious influx of water, after reaching a depth of 724 ft. Connection has since been made between this shaft and the shallower coal area, and in future much of the output of coal will be hoisted by this outlet. The exploration of the coal deposit has been actively pushed, with results that are satisfactory. The seams disclosed are not so much faulted, and are of workable thickness. During the year, 26,047 tons of coal was raised, of which 20,458 tons was sold through the Transvaal Coal Owners' Association, and the remainder used at the mine. Three years ago the output was 100,000 tons. The present indications are that a

monthly output of 10,000 tons will be reached within a short time. The proved reserve covers 90 acres in the southwest part of the property. Thomas Pearson is mine manager, S. C. Thomson is consulting engineer, and the company is housed with Ochs Brothers.

East Rand Coal, Coal, & Estate.—This company was formed in 1895 to acquire property in the east Rand at Vischkuil, which in fact is the farthest east of any mine on the Rand. Boring has been done for gold, and the coal deposits have been worked. The colliery has been continuously profitable since 1910. The report for the year ended June 30 shows that during that time, 135,796 tons of coal was mined, of which

East Rand Mining Estates.—This company was formed in 1901 by Lewis & Marks to acquire property in the far east Rand, particularly on the Grootvlei and Vlakfontein farms. The Grootvlei was floated as a subsidiary company in 1904, and boreholes were sunk proving the continuity of the gold-bearing formations. Shafts were sunk, but operations had to be suspended owing to the influx of water. The report now issued, for the year ended June 30 last, shows that the directors are closely watching the latest developments in the far east Rand, and are ready at any time to re-start operations. The company has cash in hand amounting to £60,000.

Nourse Mines.— This company was formed in 1894, as the Nourse Deep, for the purpose of acquiring the deep levels of the Henry Nourse mine in the central part of the Rand. In 1905 the Henry Nourse property was absorbed, and the name changed. The direction is with the Rand Mines company. B. Madew is consulting engineer, and R. A. Barry is manager, with P. W. Sherwell as acting manager at present. The report for the year ended July 31 shows that 718,621 tons of ore was mined, and after the rejection of 15% waste, 609,750 tons was sent to the mill, averaging 31s. 10d. per ton. The yield by amalgamation was 165,914 oz., and by cyanide 55,555 oz., making a total of 221,369 oz. or 30s. 6d. per ton milled. The sale of gold brought an income of £928,921, and the working cost was £684,278, or 22s. 6d. per ton milled, leaving a working profit of £244,623, or 8s. per ton. As compared with the previous year, the tonnage milled showed a decrease of 34,425, the yield an increase of 1s. 5d. per ton, and the cost an increase of 11d. per ton. Developments during the year have revealed 693,893 tons of profitable ore, and on July 31 the reserve was estimated at 1,969,000 tons, averaging 6.6 dwt. The figures for tonnage show a slight decrease, owing to some parts being now rejected owing to the faulted nature of the ground. The mine contains large amounts of blocks of problematical ore, as much as 500,000 tons averaging between 3.5 and 4.7 dwt.

Consolidated Main Reef.— This company was formed in 1896 to acquire the gold-mining properties in the middle west Rand owned by the Main Reef and the Consolidated Angle-Tharsis, two companies which were formed respectively in 1888 and 1893. Other adjoining properties have been purchased since. The control is with the Neumann group. Though milling started in 1888, no divisible profit was made until 1907, and during this long period operations were suspended several times. The report for the year ended June 30 shows that the output and profit have been well main-



35,280 tons was rejected as waste, 1253 tons used on the spot, and 99,263 tons sold through the Transvaal Coal Owners' Association. The profit on the sale of coal was £6628, and other profits and interest amounted to £1840. Administration and taxes absorbed £1592, and £5000 was distributed as dividend, being at the rate of 10%. The erection of electrical plant has been commenced, and when complete will increase the capacity to 18,000 tons of saleable coal per month. Developments are well ahead. V. Holbeach is manager.

tained, and that the developments have disclosed increased amounts of ore of higher grade. During this period, 272,897 tons of ore was raised, and after the rejection of 11% waste, 242,416 tons was sent to the mill averaging 7.2 dwt. per ton. The total extraction by amalgamation and cyanide was 83,722 oz., or 6.9 dwt. per ton. The income from the sale of gold was £350,423, or 28s. 11d. per ton milled. The working cost was £256,289, or 21s. 1d. per ton, leaving a working profit of £94,134, or 7s. 9d. per ton. These results are nearly identical with those obtained during the previous year. The dividend absorbed £80,881, being at the rate of 8½%, as compared with 7½% the year before. As regards development, it is notable that on the 20th level, in the western section of the mine, 1070 ft. has given an average assay of 11 dwt. over a stoping width of 48 inches. The ore reserve has been increased by 63,790 tons, and stood on June 30 at 610,680 tons; at the same time the average content has increased from 6.7 to 7.26 dwt. A new deep-level shaft has been sunk and a cross-cut is being driven to the 20th level west. When this is completed, a larger amount of ore can be raised, sufficient to keep the whole of the stamps going continuously; at present an average of only 100 out of the 120 are at work.

Main Reef West.—This company owns a mine which is the immediate neighbour of that of the Consolidated Main Reef, particulars of which are given in the above paragraph. S. C. Thomson and C. H. Spencer are consulting engineer and manager, respectively, of both mines. The Main Reef West was registered in 1899, but it was not until the beginning of 1909 that milling commenced. The metallurgical plant now consists of 120 stamps and 3 tube-mills. The report for the year ended June 30 shows that scarcity of labour has interfered with mining operations, and that the new ground developed has contained ore of lower grade. The ore raised during the year was 215,488 tons, and after the removal of 14% waste, 185,731 tons was sent to the mill, a decrease as compared with the previous year of 11,000 tons milled. The average number of stamps running was 81 out of 120. The extraction of gold by amalgamation and cyaniding was 73,471 oz., or 7.9 dwt. per ton milled. The income from the sale of gold was £307,709, or 31s. 1d. per ton milled. The working cost was £203,469, or 21s. 11d. per ton, leaving a profit of £104,240, or 11s. 2d. per ton. Debenture interest absorbed £18,366, taxes £14,166, and £6029 was charged to revenue account for shaft-sinking. The shareholders received £73,678, being at the rate of 15%. The ore reserve on June 30 was 685,720 tons, averaging 6.36 dwt. per ton. These figures show an increase in tonnage of 57,640, and a decrease in content of 0.64 dwt.

Linares Lead.—This company was originally formed in 1852 by John Taylor & Sons to acquire lead mines at Linares, Spain, together with smelting works at Cordova. For many years good profits were made, but nothing has been earned since 1907. In 1906 the company was re-constructed, and further working capital raised, with a view of prosecuting developments and examining other properties. The report now issued covers the year ended June 30 last, and shows that the leases of the various mines have been abandoned and the disposable plant and property sold. By the advice of Ernest R. Woakes, who was formerly the manager, the Engracia mine, near Azagua, in the province of Badajoz, has been acquired. This mine in previous years yielded lead ore from surface workings. A vertical shaft is being sunk, and when it is deep enough, a cross-cut is to be driven to intersect the lode.

Fortuna.—This company was originally formed in 1854 by John Taylor & Sons to acquire lead mines in Spain, near those of the Linares company, mentioned in the preceding paragraph. Dividends were paid until 1901, when the company was re-constructed. Since then, the various properties have been sold, and others acquired. Of these, the La Salud and Amalea lead mines, in the province of Badajoz, have proved the most hopeful, and by the advice of Ernest R. Woakes, the former superintendent, are now being developed.

Ashanti Rivers & Concessions.—This company was formed in 1902 as the Ashanti Goldfields Auxiliary, being an off-shoot of the Ashanti Goldfields Corporation. It was amalgamated in 1910 with the Ashanti Properties company. It owns extensive dredging concessions in West Africa, on the rivers Ofin, Adra, and Jim, which are worked by a number of subsidiary companies, and the Wuamassi and Abotenduah concessions, adjoining the properties of the Ashanti Goldfields Corporation, worked by the company itself. The report for the year ended April 30 shows that the drought caused the river Ofin to be so low for quite half the time that the dredges could not be floated to the best patches; nevertheless the production of gold showed an increase, the figure being 3825 oz. An option has been taken on the Domnaku Esika lode property, adjoining the Ettadoom mine of the Sekondi & Tarkwa company. Work on the Miradani property has been rewarded by the discovery of a promising lode. T. Bowyer Bower is manager.

TRADE NOTES

Most of the trade publications mentioned in this column are available for distribution and the manager of The Mining Magazine will be pleased to secure copies for persons interested.

Fraser & Chalmers have strengthened their dredging department by retaining H. G. Peak and S. J. Weiss, both of whom have had long experience in dredge construction.

Boving & Co. have issued a 36-page booklet, which serves to illustrate the various branches of business carried on under this name. It is interesting to note that this company has delivered 1200 turbine wheels within the past seven years.

'The Excavating Engineer' is a monthly publication devoted to subjects relating to excavating. The first number (October 1912) gives several interesting comments on the steam-shovel work on the Panama Canal.

The Sullivan Machinery Company's publications are always interesting. In the *Mine & Quarry* for October, the leading articles are "Coal Mining in Oklahoma," "Submarine Rock-Drilling," and "Portable Drilling Outfits."

Head, Wrightson & Co. report recent sales of Nissen stamps to the Transvaal Gold Trust, and the Leeuwpoort Tin Mining Co., both in South Africa; two eighteen-foot Hendryx agitators to the Transvaal Gold Trust, and one to the Transvaal Consolidated Trust for the Fairview mine.

McKiernan-Terry Drill Co. are distributing a pamphlet giving additional particulars concerning the 'Busy Bee' Hammer Drill. The small space required in which to manipulate the drill forms a strong argument in its favour, and it is claimed by the makers that the drilling power has not been sacrificed for the sake of compactness. The Oil Well Supply Co. are the London representatives.

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Scientia non habet inimicum nisi ignorantem.

T. A. RICKARD, Editor.

EDGAR RICKARD, Managing Director

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CONTENTS.

	PAGE		PAGE
STATISTICS OF PRODUCTION.....	394	DISCUSSION	
REVIEW OF MINING.....	395	The Engineer in the Tropics.....	
EDITORIAL		..... E. Homersham	437
Notes.....	402	Cemented Ore..... Ernest Williams	438
A Christmas Suggestion.....	405	Definitions..... W. H. Shockley	438
Combination Smelting	405	Loose Nomenclature..... Alex. Colledge	439
Royal School of Mines	406	Processes and Publicity.....	
Another Group	407	..... Theodore J. Hoover	439
Phantom Profits	409	Mine Valuation and Mine Finance...	
Consolidated Oil Fields.....	410	..... Ernst Lichtenberg	439
Criticism	411	Cam & Motor Gold Mining Company	
Consolidated Gold Fields.....	412	..... Pearse, Kingston & Browne	440
Stripping Frozen Gravel	413	'Modern Mine Valuation'.....	
Editors and Secretaries	415	..... M. H. Burnham	441
SPECIAL CORRESPONDENCE		A Christmas Suggestion..... H. G. Payne	441
Johannesburg.....	419	PERSONAL	417
Melbourne.....	422	METAL MARKETS	418
Kalgoorlie.....	425	PRÉCIS OF TECHNOLOGY	
San Francisco.....	426	De Bavay's Process.....	455
Mexico.....	428	Nigerian Tin.....	455
Camborne.....	430	Concrete Shafts.....	456
Toronto.....	432	Ferro-Concrete Mine-Supports.....	457
New York.....	434	Low-Speed Chilean Mills.....	457
St. Louis	435	Tellurides at Kalgoorlie.....	457
ARTICLES		Exothermic Steel	458
Cobalt..... Charles A. O'Connell	442	Electric Zinc Furnaces	458
Mining Possibilities in Turkestan.....		Ancient Bronze	458
..... Algernon Noble	444	Fink's Smelting Process	459
A New Copper District.....		CURRENT LITERATURE.....	460
..... J. W. Bryant	448	BOOKS REVIEWED.....	460
Reinforced Concrete for Roofing a		COMPANY REPORTS.....	463
Level..... W. Fischer Wilkinson	450	TRADE NOTES	470

STATISTICS

STOCKS OF COPPER IN ENGLAND AND THE CONTINENT.
Reported by Henry R. Merton & Co. Tons of 2240 lb.

	Sept. 30 Tons	Oct. 31 Tons	Nov. 30. Tons
In England.....	29,549	28,377	26,818
In France.....	7,584	6,923	4,873
Afloat from Chile.....	1,825	2,400	2,725
Afloat from Australia.....	5,250	5,600	6,400
In Rotterdam.....	350	350	350
In Hamburg.....	3,287	2,341	2,215
Total European visible supply.....	47,915	46,341	43,281

AMERICAN COPPER PRODUCERS' ASSOCIATION'S FIGURES.
In Tons of 2240 lb.

	Production.	Domestic	Deliveries Foreign	Total	Stocks at end of month
Total, 1911.....	639,258	316,791	337,009	653,800	39,937
January 1912.....	53,272	27,832	35,789	63,621	29,589
February.....	51,801	25,101	28,191	53,292	28,098
March.....	50,114	30,128	26,291	56,369	27,833
April.....	56,011	31,033	23,773	54,806	29,048
May.....	56,570	32,456	31,020	63,476	22,142
June.....	54,605	29,521	27,434	56,955	19,792
July.....	61,233	31,738	26,840	58,578	22,447
August.....	65,013	35,144	31,467	66,611	20,849
September.....	62,540	28,330	26,904	55,234	28,155
October.....	64,913	37,546	31,259	58,806	34,262
November.....	60,132	30,970	24,959	55,929	38,465

PRODUCTION OF GOLD IN THE TRANSVAAL.

	Rand	Else- where	Total	Value
	Oz.	Oz.	Oz.	£
January 1912.....	709,280	27,760	737,040	3,130,830
February.....	674,960	28,906	703,866	2,989,832
March.....	704,725	31,968	736,693	3,528,688
April.....	706,763	30,897	737,660	3,133,383
May.....	746,948	32,714	779,662	3,311,794
June.....	722,588	31,348	753,936	3,202,517
July.....	735,941	30,397	766,338	3,255,198
August.....	711,197	32,540	743,737	3,248,395
September.....	716,495	31,398	747,893	3,176,486
October.....	738,082	30,599	768,681	3,265,150
November.....	727,699	29,638	757,337	3,216,965

* Including 70,143 oz. worth £297,946 extinguished reserve.

COST AND PROFIT ON THE RAND.

	Tons	Yield per ton	Cost per ton	Profit per ton	Total profit
	s	d	s	d	£
1911.....	23,888,260	27	18	0	11,414,863
January 1912.....	2,067,161	27	6	10	997,557
February.....	1,980,396	28	1	2	907,192
March.....	2,163,998	28	1	11	1,204,764
April.....	2,059,562	28	6	10	1,005,920
May.....	2,177,348	28	6	18	1,078,333
June.....	2,110,637	28	6	10	1,063,634
July.....	2,149,785	28	6	18	1,061,089
August.....	2,121,455	28	9	10	1,055,315
September.....	2,081,295	28	7	18	1,040,820
October.....	2,200,709	28	0	18	1,079,334

NATIVES EMPLOYED IN THE TRANSVAAL MINES.

	Gold mines	Coal mines	Diamond mines	Total
January 31, 1912 ..	184,046	7,805	9,524	201,375
February 29 ..	180,520	7,922	10,789	200,301
March 31.....	196,748	8,198	12,071	217,017
April 30.....	197,937	8,364	13,785	220,086
May 31.....	193,829	8,460	14,538	216,827
June 30.....	188,494	8,549	15,530	212,573
July 30.....	182,925	8,497	15,834	207,256
August 31.....	179,111	8,766	15,934	203,811
September 30 ..	180,739	8,783	15,752	205,274
October 1.....	182,058	8,803	15,496	206,357
November 1.....	186,881	8,767	14,872	210,520

GOLD OUTPUT OF INDIA.

Year 1910	Year 1911	Nov. 1912	Year 1912	
£2,104,858	£2,150,050	£193,265	£2,064,093	
PRODUCTION OF GOLD IN RHODESIA.				
MONTH.	1908	1909	1910	1912
	£	£	£	£
January	199,388	204,666	227,511	214,918
February	191,635	192,497	203,888	209,744
March	200,615	202,157	228,385	215,102
April	212,935	225,700	228,213	221,476
May	223,867	225,012	224,888	214,107
June	224,920	217,600	214,709	226,867
July	228,151	225,234	195,233	240,514
August	230,792	228,296	191,423	239,077
September	204,262	213,249	178,950	230,573
October	205,466	222,653	234,928	230,072
November	196,668	236,307	240,573	—
December	217,316	233,397	199,500	—
Totals	2,526,007	2,623,788	2,568,201	—

PRODUCTION OF GOLD IN WEST AFRICA.

MONTH.	1910		1911		1912	
	Oz.	Value	Oz.	Value	Oz.	Value
		£		£		£
January	17,357	70,693	15,903	66,107	26,098	107,262
February	16,976	68,469	15,179	61,081	25,009	100,770
March	17,627	71,954	16,387	67,673	27,228	111,376
April	16,363	67,069	17,237	70,880	27,790	114,796
May	16,590	68,355	20,467	96,409	28,015	115,678
June	17,194	70,988	22,555	92,174	27,784	114,697
July	15,564	58,551	22,510	91,955	30,973	127,800
August	13,921	57,713	25,385	101,753	33,015	136,407
September	11,497	47,746	26,717	109,039	34,491	142,397
October	13,341	55,046	26,826	109,503	34,436	142,414
November	14,021	57,658	24,280	99,299	—	—
December	15,042	61,737	24,369	99,569	—	—
TOTALS	185,493	755,985	261,784	1,069,442	—	—

PRODUCTION OF GOLD IN WESTERN AUSTRALIA.

	Export oz.	Mint oz.	Total oz.	Total value £
Total, 1910.....	363,496	1,209,856	1,573,352	6,682,042
Total, 1911.....	160,021	1,210,447	1,370,468	5,823,522
January 1912.....	10,697	95,763	106,460	451,828
February.....	10,441	92,061	102,502	435,526
March.....	408	92,597	93,005	395,058
April.....	10,698	99,708	110,406	468,972
May.....	9,288	98,104	107,392	456,170
June.....	1,214	106,930	108,144	459,605
July.....	8,802	96,838	105,640	448,728
August.....	7,262	101,377	108,639	461,466
September.....	1,580	109,575	111,105	472,170
October.....	10,288	95,977	106,265	451,382
November.....	8,065	99,134	107,219	455,434

OTHER AUSTRALASIAN GOLD PRODUCTION.

	1910	1911	November 1912	1912
	£	£	£	£
Queensland.....	1,840,337	1,625,390	127,200	1,237,000
New South Wales ..	803,727	769,353	—	696,070
New Zealand.....	1,896,322	1,808,000	105,000	1,294,182
Victoria.....	2,422,700	2,148,000	1,200,000	1,614,300

* October figures only.

SALE OF TIN CONCENTRATE AT REDRUTH TICKETINGS.

	Tons	Value	Average
Year 1911.....	5,701,566	£114 4 5	
Jan. to October 1912.....	5,178,007	£126 5 9	
November 11.....	614	£16 10 5	
November 25.....	2,131	£18 10 7	

EXPORTS OF TIN AND ORE FROM STRAITS AND BOLIVIA
Reported by A. Strauss & Co.

	1911 tons	Nov. 1912 tons	1912 tons
Metal from Straits to Europe.....	55,135	5,665	3,034
Metallic Content from Bolivia to Europe.....	2,577	1,599	18,959

REVIEW OF MINING

INTRODUCTORY.—By a fortunate, coincidence the near approach to Christmas synchronizes with the cessation of hostilities in the Balkans. It is also pleasant to chronicle the fact that negotiations for peace between Turkey and the Allies are to take place shortly in London. Thus a troublous year will end, it is confidently believed, in calm. It is true, since the first declaration of war, followed immediately by panics at Paris and Berlin, our own markets have remained commendably firm, despite the trepidations of the continental bourses. But the grim spectre of war on a comprehensive scale has chilled the confidence on which the expansion of business is based and has threatened to freeze the divergent currents of speculation. We shall be glad when peace is assured. During the past month the mining markets have shown a healthy tone. The Gold Fields meeting and the obsequies of the Jemaa lode may be coupled as depressing episodes, but these are more than compensated by the ending of the labour troubles in New Zealand, the breaking of the drought in South Africa, and the continued good news from the Far East Rand. At New York a financial stringency has been caused by trust decisions, imminent changes in the tariff, and labour unrest. But all of these are annoyances familiar to the industrial development of the other side, so that they need not cause undue anxiety. Our correspondent at New York writes with impressive cheerfulness concerning the expansion of business in the coming year. With us also the outlook is good. Trade continues to expand to a surprising degree. Prices of metals are high. The search for them is being stimulated. The exploitation of ore deposits is bound to receive wider attention in the wake of this industrial demand for metals.

TRANSVAAL.—The small increase in gold production during October was entirely normal, allowing for the fact that the month was one of 31 days, as compared with September. In November the output was 757,337 ounces. During the first 10 months of the current year the output was equal to that of the whole of 1910, and the yield for 11 months this year is slightly larger than the total last year. As regards the labour supply, the monthly statistics showed an increase for October, as was expected. The increase of 1319 compares with a loss of 425 in the corresponding month last year. Apparently the drought in south-central Africa has helped recruiting. At the end of November a further gain was recorded, making a total of 186,881 employed on gold mines, as compared with 176,736 at the same date last year. Undoubtedly the recent drought has tended to drive the natives to seek wages at the mines.

The comparative statement of yield, cost, and profit per ton is, as usual, vitiated by the fact that the cost includes only part of the expense incurred, so that the profit is phantasmal to an extent varying between 25 and 30%. However, we note that the yield in October was 7 pence per ton less (on 2,200,709 tons) than in September, although 1s. per ton higher than in October last year. The total profit supposed to have been earned by all of the mines during the month is given as £1,079,334, but the net resultant profit will prove to be about £750,000.

Our Johannesburg correspondent's statement concerning the secession of several collieries from the Coal-Owners' Association is authoritatively denied in London. On the other hand we hear that the action of the Robinson group in keeping out of the new co-operative native labour organization is causing

trouble, by drawing contract-boys from the other groups. The whole effort to diminish rates is being upset, not for the first time, by Sir Joseph.

The Brakpan is expected to declare an increased dividend for the second half-year, while the City Deep and Modderfontein B will each distribute their first dividend. These will serve to compensate for lesser declarations elsewhere on the Rand.

Various reports have been circulated concerning the enlargement of the New Modderfontein plant, but they are officially contradicted. No addition is to be made at present. The existing capacity is 52,000 tons monthly and the rapid growth in the reserve, to 4,000,000 tons of 8 dwt. ore, suggests the fulfilment of the plan to increase the monthly capacity to 90,000 tons. Apparently the management is following a cautious policy, having regard to the possible shortage of labour.

The Government has issued a fresh invitation for tenders to lease 2235 claims on the farms Brakpan No. 16 and Schapenrust No. 13 in the Far East Rand. It is slightly more than two years since the first invitation was made, and without response. The terms are onerous. A capital expenditure of £1,200,000 is estimated, that is, a sum equal to that consumed before the Brakpan reached a productive stage. A yield of 12,500 tons per claim and a life of 30 years is assumed.

Insufficiency of water is hampering operations at several mines, notably the Jagersfontein and Koffyfontein.

The Voorspoed diamond mine has been transferred to De Beers, by consent of the Government, which insisted on the operation of the Voorspoed and thus compelled the directors to liquidate.

The Van Ryn Deep is adding to its reserve of ore in a most satisfactory manner. But why does the company continue to publish the meaningless figures concerning "unpayable" ore? Rock containing 1.5 dwt. gold per ton

in a deep mine in South Africa is waste; it would be just as much to the point to give the tonnage of quartzite or diabase.

RHODESIA.—The output of gold in October was almost the same as in the month preceding, despite the extra day. The production from individual mines calls for little comment, but it may be noted that the Globe & Phoenix exhibits the largest decrease, namely, 522 ounces. Next in this regard comes the Selukwe Columbia, with a decrease of 393 ounces of gold. These two items more than suffice to explain the total decrease of 108 oz. On the other hand, small gains are recorded by the Bucks Reef, Matabele Queen, and Wanderer. In October the total number of producers was 171, as compared with 186 in September, indicating the effect of the drought on small mines and prospects.

At the Eldorado the lode has been cut on the 10th level, with results that are highly satisfactory. For 15 feet the average assay is 1 oz. 12 dwt. per ton for a width of 6 feet. This compares with an average of 1 oz. 3 dwt. per ton over the 110 feet proved on the 9th level. We fail to understand, however, why the assay results were not cabled until Wednesday, December 3, although the lode was cut on Friday, November 29. It does not require many hours to take a sample and make an assay.

Optimism is a good thing in mining, but it should have a reasonable basis. We don't like the pseudo-scientific statements sent from the Giant Mines. So-called "acid dikes" do not mean much; the simple question is: Was the enrichment constituting the orebody formed before or after the dislocation of the lode by the dike? That is a question that a competent mining geologist should be able to answer; the rest is only academic geology.

In regard to the Cam & Motor, we publish a letter in disagreement of a statement appearing in these columns a month ago. At the annual meeting, nothing significant was

said concerning metallurgical matters, except that Mr. F. A. Govett confessed that "the proposition had been a difficult one."

On the occasion of his brief visit to London, Mr. A. H. Ackermann gave a favourable report of progress to the board of the Eileen Alannah. It is claimed that 216,438 tons of ore assaying 56s. per ton has been blocked out, and that there is about 85,000 tons of lower-grade stuff assured. Hence it has been decided to cease further development, pending the erection of a mill, the design of which is now being planned by metallurgists on the spot.

The reported finding of "immense deposits" of coal in the Katanga region, on the banks of the Lukuga, is interesting, especially if any of it proves suitable for making coke, to be used by the copper smelters of the Tanganyika Concessions. As to that, nothing has been said.

The Union Minière publishes a balance-sheet showing a loss of 481,889 francs on metallurgical experiments. This is not excessive. Some more ought to have been spent—not lost—on expert metallurgical advice. The account of the annual meeting, at Brussels, indicates that selected copper ore is being smelted, for it assays 16% as against an average of 10% in the mines. During 1911 and 1912 two smelting campaigns have been made on a consumption of coke ranging from 2'65 to 3'44 tons of coke per ton of copper. The cost of the Wankie coke delivered is about 150 francs per ton. Meanwhile the Union Minière is erecting its own coke furnaces at Lubumbashi. The metallurgical scheme formerly suggested appears to have been discarded. Experiments in sorting, washing, and concentration by water are now in progress. The actual cost, on the spot, of producing ingot copper is said to be 800 francs per ton, without provision for delays and accidents such as are frequent at Katanga. If an allowance be made for this item, plus the cost of transport to Europe, plus the expense of ad-

ministration, the total cost would be about £50 per ton, as compared with the estimate of £25 per ton given to the shareholders three years ago.

WEST AFRICA.—The Chamber of Mines gives the gold output in October as 34,436 ounces, worth £142,414. The number of ounces is slightly less but the value is given higher than the corresponding figures for the preceding month. No notable changes of individual production are recorded.

The Ashanti Goldfields is a bright spot in the West African jungle. During the past year the cost per ton was reduced from 43s. 1d. to 35s. 5d.; this is a notable reduction. Moreover, it is real, not phantasmal. Owing to this improvement and to the larger tonnage treated, the total profit—and a real profit it is—was £214,400, as against £154,900 last year. This is reflected directly—as it always is in the case of real profit—by an increase in the dividends, from 75% last year to 87½% this year. We note also that the three directors of the original board voluntarily relinquish a further 3% out of the 10% commission on profit to which they are legitimately entitled by virtue of the terms of the contract under which the company was organized. In 1905 they surrendered 4%, so that the commission is now only 3%, in lieu of which they receive fees, by no means unreasonable.

The quarterly report of the Abbontiakoon furnishes another Gold Coast disappointment. The revenue was £31,933 and the expenditure £30,088. The yield was 7'47 dwt. per ton. Better results are hoped for, but it is evident that the expectation of cheap exploitation is illusory. The item of development redemption represents 5s. per ton. The information is given frankly and the management is evidently doing its best under trying conditions.

An official report on the tin industry of Northern Nigeria gives the output of tin as 774 tons in 1910, 1470 tons in 1911, and 1489 tons in the first 7 months of 1912. The activ-

ity in wild-cattling may be gauged from the fact that 22,818 acres were covered by new leases during 1911. The total area blanketed with mining leases at the end of last year was $54\frac{1}{2}$ square miles. The Inspector of Mines refers to the inadequacy of the labour supply, but expects that it will be overcome as soon as the natives learn to appreciate the chance to earn good wages.

Among the regrettable incidents arising from ill regulated speculation in Nigerian tin ventures, we may mention the Nassarawa, the parent of the Ninkada. It appears that long after the engineer on the spot, namely, Mr. H. A. Judd, had advised his directors that the property was valueless, no such information was given to the shareholders. Meanwhile the Ninkada company was organized by the same controllers to acquire exclusive prospecting rights over 3 square miles of the territory said to have been acquired by the Nassarawa from the New Development company. It happens that the original application, which was not in order, had been made for 3 square miles only, so that the Nassarawa would have relinquished the whole of its nebulous property. Even the 3 square miles, when tested by numerous pits and trenches, proved to be lacking in the essential mineral, namely, cassiterite. It was ilmenite that had fooled the company's prospector.

Among the few sensible reports emanating from Northern Nigeria is that of Mr. W. J. Shephard, manager of the South Bukuru. He says that the "first thing necessary" is "to prospect the properties before hurrying in any plant." Hence he is testing the ground systematically.

The Gurum River is another enterprise that requires re-valuation, for it is officially conceded that the new manager "does not confirm the estimates of the late management with regard to reserves and values."

The latest cablegram issued by the Anglo-Continental, announcing the abandonment of

prospecting on the Jemaa lode, is merely a post-mortem statement. The Jemaa was a dead issue months ago.

AUSTRALASIA.—The Waihi strike is finally ended. It began on May 14 and was extinguished on November 30. For nearly seven months the strikers terrorized the community, compelling the Government to draft a large extra force of police. The effort to start a general sympathetic strike throughout New Zealand failed. The whole trouble arose from the Federation of Labour, a frankly revolutionary organization, attempting to ignore the Arbitration Act and refusing to allow its members to work with the Waihi engine-drivers who had seceded and formed a new union for registration under the Act. It is estimated that the 29 weeks of idleness and disorder caused a loss in wages of £140,000 to the 1500 men involved. A loss of gold returns to the amount of £453,000 is also mentioned, but this is illusory, for the gold is still in the ground. All that has been lost by the shareholders is the temporary depreciation of their property and the interest on the gold that might have been extracted during the $6\frac{1}{2}$ months.

The Mount Lyell has had hard luck. The labour troubles and the mine-fire prevent the declaration of a dividend for the second half-year. The management is deserving of sympathy and has our best wishes for better luck, in 1913.

At Broken Hill, the North mine at the 1250-ft. level and the South at the 1170-ft. level are looking most promising. Both are likely to increase their production at an early date. The variations of grade at the British do not inspire confidence in the uniformity of the orebody. The Sulphide Corporation announces a double dividend, indicating the favourable effect of high base-metal prices. If no labour outbreak supervenes, the Corporation ought to do equally well next year. Its lease on the Central mine, at Broken Hill, ex-

pires in 1926, but that, to the average speculator, is a long way off.

At Greenbushes, the West Australian tin district, several dredges are doing well. They are mostly controlled by Messrs. A. Moss and A. E. Morgans. With the exception of the Birthday Gift Co. and another venture, the lodes themselves are unworked, being too low-grade, that is, under 1%. The orebodies are lenticular in shape and follow shear-zones in the greenstone or diorite. While irregularly distributed they are usually parallel to the foliation of the so-called greenstone schist. Some of the orebodies are of big dimensions. In the early geological reports they were described as pegmatite and greisen dikes in granite, but this description is said to clash with the evidence obtainable in the Cornwall and Cornwall South mines. It is believed that the high price of tin may stimulate another effort to exploit these ore deposits.

At the Gwalia Consols, Mr. Ben Howe is developing a process of volatilizing the gold from the ore by a chloriding roast. A 2-ton trial gave an actual recovery of 92% of the gold. In small laboratory tests it has been possible to obtain 98%. Ore from the Lancefield has also proved amenable to this treatment. The Gwalia ore is particularly rebellious; it has been tried by almost every known process, and has been the subject of experiment for many years. Hitherto the best results have been obtained by roasting and cyaniding; but by that means the maximum recovery is only 85%, and in practical working it has not been possible to exceed 80%. Hence Mr. Howe's work is being watched with keen interest. It suggests kinship with the Richards tin-reduction method, now prominently mentioned in Cornwall, and the earlier Pohle-Croasdale process, exploited by the Metals Volatilization Company at Denver, nearly ten years ago. There the trouble was not to volatilize, but to collect, the metals after volatilization.

We are amused at the statement made by the chairman of the Mount Elliott in regard to the life of that copper mine. He acknowledged that he did not know, and appeared proud of this fact, for the answer, so he said, "is one which I hope that I or whoever may occupy this chair may be able to give for many years to come." Of course, it is pleasant to have a young mine of expanding promise, and we congratulate Mr. Herbert J. Hill on it, but we fail to understand how anybody can value the mine or his shares in the company unless he has some sort of idea of the length of time it will continue to be profitably productive.

On November 12 it was announced that the strike affecting the Blackwater, Progress, and Wealth of Nations mines, all of them controlled by the Consolidated Gold Fields of New Zealand, had been satisfactorily settled. A general resumption of operations ensued. Since then the manager has cabled that 25 stamps are running at the Wealth of Nations and 30 stamps at the Progress.

Our Kalgoorlie correspondent refers to the Boulder Proprietary's option on the Great Victoria mine, at Southern Cross. This is one of the largest low-grade lodes discovered in Australia, and promises to rejuvenate the Great Boulder company. We understand that Mr. Richard Hamilton estimates 2,000,000 tons of 10s. ore. The mine is only 300 ft. deep, but the orebody is 270 ft. wide and maintains that width as far as tested.

A bill introduced by the West Australian Government gives it the right to inspect, examine, and sample mines; also to limit the height of stopes to 10 feet, and that of rises to 20 feet, except in special cases. This legislation is bound to arouse vigorous protest.

CANADA.—Owing to the high price of lead, the miner in British Columbia is no longer in receipt of the Government bounty on that metal. The maximum bounty payable is £3. 10s., when the price for lead is £18, a

quotation now long passed. In general, mining affairs in this coastal province are quiet, but healthy and improving. Among promising ventures we may mention the Standard, a silver-lead mine in the Slocan, now paying dividends; the Sullivan in the East Kootenay, one of the properties controlled by the Consolidated Mining & Smelting Company of Canada, yielding a complex zinc-lead ore, the zinc constituent being as yet non-realizable; the Britannia copper mine, on Howe Sound, an enterprise of belated promise; and the Hidden Creek mine, on Observatory Inlet, which it is hoped may restore the fallen fortunes of the Granby Consolidated. The high price of the base metals should stimulate prospecting in this part of the American continent.

INDIA.—The Jibutil Mines of Anantapur is making an issue of 50,000 new shares of 10s. each, carrying the right to a 20% non-cumulative dividend. This extra capital is required to complete the equipment and continue development, and it probably would not have been wanted had not the shipment of the machinery been greatly delayed by the strike in England. The recent developments at this property have been decidedly promising.

MEXICO.—Under Special Correspondence, we publish a letter giving the personal experiences of a mining engineer in this unhappy country. Undoubtedly the displacement of the Diaz despotism by the invertebrate rule of Madero has encouraged all the unruly and reckless spirits that find it advantageous to pose as revolutionists. We thought that the prompt suppression of the Felix Diaz affair, at Vera Cruz, indicated the Government's ability to act forcefully, but the failure to carry out the verdict of the court martial bespoke a timidity that neutralized the earlier impression, and left the idea that Madero is unfit to be the representative of constitutional authority. Meanwhile the lack of news concerning further outbreaks encourages the view that the country

is becoming less disorderly. It remains to point out, to those who know the mineral resources of Mexico, that this is the time when enterprising syndicates can acquire mining property on reasonable terms. The troubled state of the less accessible mining districts facilitates reasonable terms because the natives are afraid to acquire property, while the representatives of foreigners need be less fearful they being unlikely to be attacked. To get hold of mines now and to wait for better days is a policy that should recommend itself to those who know Mexico.

UNITED STATES.—We publish letters from New York, San Francisco, and St. Louis, giving trustworthy news, *inter alia*, concerning oil developments in California, lead-zinc mining in the Missouri region, and general business conditions. In California the production of fuel-oil is excessive while that of light refining oil is inadequate for the demand. Too many wells have been drilled, irrespective of market conditions. What is needed, is the introduction of engines designed to employ crude oil, thereby utilizing that surplus product.

Alaska gold mines have done well this season, especially those on Douglas Island and near Juneau. The monthly reports of the Alaska Treadwell, Alaska Mexican, and Alaska United, have been full of comfort for stockholders. The new power-plant on Nugget creek is now in operation and the new hoist at the 700-ft. shaft is nearly ready. Across the channel the long adit necessary to open the Alaska Juneau is being driven at an increasing rate of speed each month. In October the heading was advanced over 400 ft. In preparation for active work next year a place has been graded for the new mill, and a flume and ditch are being constructed to bring water to the site.

As regards tin, we learn that the York Dredging Co., lessees of claims on Buck creek, near Cape York, in northwestern Alaska

will be shipping about 175 tons as the yield for the season now closed. A Union Construction or flume type of dredge has been employed digging to a maximum of 10 or 12 feet.

RUSSIA.—The season of the Lena Gold-fields is closed. It is announced that the output for the financial year is £979,173. How this compares with previous years is shown herewith :

Year	Gravel washed Cu yard	Gold £	Yield per yard
1910	748,896	1,551,849	41s. 5d.
1911	881,000	1,619,408	38s. 9d.
1912	554,339	979,173	34s. 4d.

Again we say that the cost of operations is enough to make a dead miner turn in his grave. During the past year this item was 25s. per cubic yard. Of course, the strike, and the protracted labour troubles ensuing, crippled operations. The Government report is not to be issued. But the position is unsound in other ways. Early in the season the richest ground was worked, while at the end the yield fell as low as 22s. 6d. per yard. Apparently the profit earned by the Lenskoie this year is only £206,000, of which the Lena Gold-fields will receive two thirds, and even this will not be distributed until next July.

The Troitzk has done poorly during the last quarter, but the results are said to be non-representative owing to repairs and alterations in the mine and machinery. The yield was 9'95 roubles, and the cost 10'43 roubles, per ton, but even this does not include development. It is a depressing venture.

CORNWALL.—Good news comes from Dolcoath, where the winze sunk 35 fathoms below the 510-fm. level has cut the lode, exposing 6 feet of ore assaying 60 lb. black tin equal to about £4 per ton. This compares with an average recovery of 36 lb. black tin per ton during the first half of this year.

A report by Mr. G. R. Nicolaus on the Gwithian Sands property has been issued by the Rayfield company. He finds 722,715 tons of sand assaying 9'35 lb. tin per ton, worth,

19s. per ton at the present price of the metal. He allows 4s. per ton for cost and estimates a 60% extraction. This is a picturesque enterprise, and if the data are correct it should prove highly successful.

VARIOUS.—Among the most productive of Spanish lead mines is the New Centenillo, in the province of Jaen. This is producing 2000 tons of an 80% lead concentrate monthly and has just paid a 120% bonus dividend for the past year. It began to pay handsomely about 7 years ago and is a family affair controlled by Thos. Sopwith & Co., with whom Mr. John Hazelden, the manager, is associated.

The Mawchi Tin & Wolfram company issues a report by Mr. A. F. Kuehn. Owing to the comparative remoteness of the mines, in Burma, 85 miles by trail from the nearest railway, the transport of concentrate presents many difficulties. Several promising veins have been disclosed, promising an output of 1000 tons of tin and wolfram concentrate as soon as the mill is constructed.

In Bolivia some Pennsylvania Railroad people have acquired control over the Pearl Lake gold mine. This is producing from 12 to 14 tons of tin concentrate monthly, at present. The district is an old one, formerly worked by Spaniards. Two 20 h.p. Diesel oil engines are found economical. The widest stope is from 5 to 6 metres, the ore being removed without timbering, using waste for filling and supporting the hanging wall by pillars of dry masonry. The product is sent on llamas to Oruro at a cost of 2 bolivars per quintal.

The Chuquicamata mines, the new Guggenheim venture, in Chile, is to be managed by Mr. Frederick Hellmann, who goes thither in January. This group of mines is about 100 miles from the coast, near Calama, on the line of the Antofagasta & Bolivia Railway, at an altitude of 9000 feet. The principal ore is brochantite, an insoluble sub-sulphate of copper. Mining is to be done by steam-shovel.

EDITORIAL

UNREASON is never better exemplified than in the demand of shareholders that directors shall forego fees when a mining company is in trouble. That is exactly the time when directors work hardest and experience the maximum of anxiety.

IT IS SAID that among those rendered anxious by the wild telegram sent from Nigeria concerning the Jemaa prospect, was the compiler of the code-book used by most of us. It appears that the thought flashed across his mind that the sender of the cablegram might have used the wrong code-word inadvertently. The anxiety was superfluous, for it is easier to use the Bedford McNeill code-book than it is to appraise a tin prospect.

A MINING ENGINEER recently in the Kolar goldfield tells us that he was impressed with the signs of metallurgical awakening evinced in the cyanide department of the reduction plants. After trials and tests of a protracted character it is now planned to introduce fine-grinding after stamp-milling, followed by filtration. It is also proposed to re-treat the huge accumulations, aggregating about 8,000,000 tons, of residue, left from milling operations that are now known to have been incomplete.

AS THE SEASON of fogs comes round and London is daily wrapped in an acrid inspissated gloom, it may be worth while to suggest once more that most of the unpleasantness of a fog is due to the sulphurous smoke issuing from myriads of dinky fireplaces, which create a dirty soot and an unpleasant draft long before they perform their imaginary purpose of heating a room. When we are not so deeply becalmed in tradition we

may awake to the fact that in more modern cities the heating of buildings is admirably effected by central heating-stations where coal is burnt under conditions ensuring perfect combustion and maximum efficiency.

THE professional directory appearing in another portion of this magazine now includes the name of John Taylor & Sons. We take this not only as a gratifying endorsement of the work that this magazine is doing but also as an acceptance of the idea that the professional directory serves a proper and useful function, by giving the names and addresses, both telegraphic and postal, of the active members of the profession. We believe it does. We feel assured, in any event, that the appearance of the name of John Taylor & Sons in the professional directory will put an end to the feeble suggestion that it is not 'good form' for British engineers to use so convenient a mode of publicity, even though their Canadian, Australian, and American friends have long made it a habit of doing so. When the oldest firm of mining engineers endorses the custom, it may be said to be fairly established.

ACCORDING to the *South African Mining Journal* the "payable tonnage," meaning the ore in reserve, in South African mines having more than 1,000,000 tons, reaches a total of 71,153,587 tons "of an average recovery" of 30s. per ton. The number of mines having more than the million tons is 29; and two of them are in Rhodesia, namely, the Shamva and the Cam & Motor. To the figures stating the resources of the Cam & Motor is attached a mark signifying "approximate." It would have been wise to put the same label on the other figures. After

all, they are only approximations. Yet they are given with meticulous precision. Thus the ore in the Witwatersrand Deep is given as 1,436,202 tons, averaging 6'79 dwt. per ton. If the mine yields 1,400,000 tons of $6\frac{1}{2}$ or $6\frac{3}{4}$ dwt. ore, it will have done well. The two decimals suggest an accuracy that is illusory, and the last two tons represent a precision that is misleading. Again, the Robinson has 2,833,794 tons of 11'4 and 4'2 dwt. stuff. When the 4'2 dwt. rock yields a dividend—not a fictitious profit—it will be a cold day in the Red Sea. The fact is, these estimates of millions of tons down to a single ton, and these statements of average to one-hundredth of a pennyweight of gold—namely, $\frac{1}{2}$ d. — per ton, are childish. An ignoramus may take them at their face value; anyone experienced in mining knows that they are arithmetical quantities of a precision having no proportion to the accuracy of the methods employed in measuring and valuing ore underground.

ONE of the valuable features of the Lena Goldfields' report is the table of Russian weights and measures. A better feature would have been the use of English weights and measures throughout the report, thus rendering an appendix supererogatory. In consequence of the employment of Russian units, the statistical portion of Mr. C. M. Rolker's report occupies a space quite disproportioned to the amount of information given. This is a depressing technical document. A decline of half a pennyweight per cubic yard is recorded; this, being slightly over 2s. per yard, would be fatal to most alluvial mining enterprises, but 2s. is a small fraction out of the total cost of 25.57s. or 6dwt. per cubic yard. Mr. Rolker has not been to the mine this year; hence his revised estimates are based on maps sent to him from Russia. He is handicapped also by lack of such customary evidence as that obtained from boreholes. Thus he is driven to report in terms of "miners' expectancy" and to the use of qualifying state-

ments so numerous as to leave few quantitative facts. Even the "probable reserves do not include any gold that may be won from the I Group, the III Group, the Balbuchta District, the Engazimo, the Industrial property, and any of the Tributaries of the Bodaibo." The question will be asked, what does it include? For this we do not blame him, or the English board, but the organization, whereby the Russian management does as it pleases, while the British holding company goes through the motions of giving information to shareholders. A report by Baron A. de Gunzburg and Mr. P. M. Saladiloff is issued, giving an account of the recent labour troubles. This has been badly translated, so that it will provoke irritation long before it conveys any sort of idea concerning the conditions that culminated in the brutalities of last April. On the whole, the Lena Goldfields makes a poor record this year.

IT IS CUSTOMARY to select a new president for the Institution of Mining and Metallurgy several months before his term of office begins. We take keen pleasure in stating that Mr. Bedford McNeill has been accorded the blue ribbon of the mining profession in the British dominions. By his kindly and humorous personality he has endeared himself to those who know him, and to those unable to avail themselves of that privilege he is known as a veteran in mining affairs and the author of a book of which it may be said that it is more useful than most books, being a prime agent in expediting that rapidity and cheapness of communication to which modern industry owes its recent worldwide expansion. We anticipate for Mr. McNeill an agreeable and useful term of office. We note also that Mr. Edward T. McCarthy has been chosen as a vice-president on the promotion of Mr. McNeill to the higher office. We do not know who the selectors are, but it is obvious that they constitute a committee of happy discernment, for the selection of Mr. McCarthy is

one that will be heartily endorsed. No mining engineer in London has won more general regard as a practitioner, combining not only a high sense of professional ethics and technical ability, but a sagacity that in a speculative business like mining is priceless. Messrs. Sidney Farrar and J. H. Corder-James retire as vice-presidents, owing to the pressure of private business. Their places are taken by Messrs. W. R. Feldtmann and F. W. Harbord. The vacancies thus created in the Council will be filled by Messrs. O. J. Steinhart and John Cadman. These gentlemen will strengthen the Council in its representative capacity. Mr. Steinhart is a metallurgical engineer of honourable prominence, while Mr. Cadman is professor of mining in Birmingham University.

WE HAVE PUBLISHED letters from correspondents who sign themselves with initials. Occasionally we insert letters over a *nom de guerre*, although the identity of the writer has been made known to us, of course, before publication. Frankly, we deprecate anonymity, and even the half-anonymity of initials. We shall continue to publish such communications, for otherwise they might be withheld, and we desire to encourage free discussion. We do, however, submit to our friends that an acknowledgment of authorship is desirable. Rare indeed is the occasion warranting mystery, especially when criticizing other people or other people's affairs. Moreover, the half-veiled attack is vastly more irritating, even to the object of it, than a straight broadside over a plain signature. In the latter case a rejoinder becomes dignified and effective, while, on the other hand, the initialled critic is a whisper in the dark or a growl in a fog. It is hardly worthy of a retort. We, in these editorial pages, usually mention names explicitly and publish criticism frankly, not only because such a method adds interest, but because it is better cricket; it allows the person or company under fire to respond in self-

defence, and then gives us a chance to withdraw or correct any statement that by inadvertence may prove to have been unfair or untrue. We try to avoid both; but if we err, it is our desire to correct promptly. As a matter of fact, half the initialled contributors to discussion have no excuse for their mock modesty or cautious obscurity of authorship. The letters do credit to their writers, otherwise we should throw them into the waste-paper basket. Gentlemen, let us have less fog and more of the open air of the mountains among which the miner spends so much of his active life.

DURING a gold mining boom in Chota Nagpur, it was rumoured that a big find of the precious metal had been made on the property of the Rajah of Orissa, another tributary state of India. The natives had been washing gravel and making 2 pence per day on the banks of the Brahmani river. Representatives of a mercantile house came down from Calcutta, but the Rajah said that the gold was of no consequence and refused to make a deal. A few weeks later the Dewan or prime minister informed the Calcutta men that the affair could be arranged for a consideration. In India that necessary lubricant to business is called 'pesh-kash,' literally a cork-screw or a thing that opens the way. This formality having received proper attention, the intending mine-operators went to the spot and there met the Rajah, who explained again that there was no gold worth mentioning, but that there was one spot which, it was stated by the natives on the ground, had been worked for gold many generations earlier and had been abandoned on account of the anger of the wood spirits. It was therefore taboo. However, the Rajah explained, if they cared to take the risk, they might investigate the old diggings. Whereupon they made some hurried tests and found gold enough to excite them. Without further delay they agreed to

pay 30,000 rupees to close the bargain and 30,000 rupees per annum for 3 years. A manager was sent down. He built a few bungalows and erected the requisite machinery, only to find that gold was quite lacking, except at one or two places. The truth was that the Rajah had taken an old musket and had loaded it with some of the gold-dust stored in the palace, for the gold-washers paid taxes in dust, and then he had shot it into the gravel. The wood spirits did not protest.

WE NOTE that *The Investors' Chronicle* arraigns the method by which the Consolidated Oil Fields of South Africa offered shares to the public, and goes on to say that "for that, among other reasons, we have declined to insert the advertisement in our pages." We proffer our hearty compliments to *The Investors' Chronicle*, which, in this respect, sets a needed example to *The Times*. *The Investors' Chronicle* appears also to have a keener appreciation of the fitness of things than *The Financial News*, which publishes, on its editorial page, a goulash or fricassee of the Oil Fields prospectus. This may be taken by unsophisticated readers as information, but, judging from other reading matter that has appeared on that page, we have no doubt that it is either a paid advertisement or a gratuitous puff given in return for an advertisement.

A Christmas Suggestion.

On another page we publish a timely letter from Mr. H. G. Payne, suggesting that an organized effort be made to help such members of the profession as are in distress, through accidents or disabilities for which they are not to blame. To this idea is attached the desire to help the widows and children of mining engineers unable to make sufficient provision for their families. We take pleasure in giving prominence to Mr. Payne's letter, with a view to inviting further suggestions from our read-

ers. Of course, the proposal should be submitted first to the Institution of Mining and Metallurgy, which, in such matters, is able, and we venture to predict, willing also, to place its organization at the service of the profession in anything touching its highest interests. If the Institution, for reasons not now obvious, should be unable to take the lead, then we shall be only too glad to initiate an effort to put Mr. Payne's idea into practical shape. We leave it thus. Among the generous sentiments evoked by this season of goodwill to all men, we ask our readers to give a kindly thought to those of their profession who have been less fortunate than themselves.

Combination Smelting.

During the last two or three years, vague reports have been circulated in the United States with regard to a new process of copper smelting that seeks to combine the duties of the reverberatory furnace and the converter, and claims to possess the additional advantage of obviating the disastrous effects of the presence of zinc in the ore. This has been invented by Mr. Edward Fink, and after a failure in practice at Garfield, in Utah, is now reported to be in a sufficiently perfected state to warrant its introduction to the public by a proprietary company specially formed for the purpose. In the *Précis of Technology* we give an outline of the process and its claims, not by any means because we are convinced of their value, but for the reason that our readers expect to find some notice in our pages of anything of general interest. In the first place we may say that we are not assured of the technical standing of the inventor, and that we would prefer that his ideas were in the hands of the skilled staff of some well-established metallurgical works rather than with an isolated financial organization. In the second case, we are doubtful about combination processes, as such, for like the combination tools sold to small boys and to unsuspecting grown-ups they gen-

erally do many things badly and nothing well. The furnace is in the form of a horizontal revolving cylinder with conical ends. Through one end a spray of oil-fuel and air is injected, and an air-blast is introduced through two lines of tuyeres arranged along the cylindrical part of the furnace. The raw ore or concentrate when first introduced is treated as in a reverberatory, by the heat from the oil-fuel; at the same time the blast through the tuyeres performs a bessemerizing action, and incidentally volatilizes the zinc in the form of oxide before it has the chance of passing into the slag or of clogging the charge. The intention is to recover the oxide in bag-houses, though nothing is being done in this direction so far. The slag is removed from time to time, and eventually, when sufficient matte has accumulated, the oil-spray is disconnected. The action then becomes one solely of bessemerization. Thus blister copper is produced from ore in a single furnace. The revolving motion has been adopted for the purpose of preventing local corrosion of the silicious lining, though why a basic lining should not be tried is not quite clear. Another advantage claimed for the motion is that during part of the time the tuyeres are out of contact with the charge, and as the blast is then cut-out, the heat of the furnace will melt the incrustation round the tuyeres. It is also claimed that when the ore-charge is first introduced, the blast through the tuyeres scatters semi-fused ore over the surface of the lining, thus helping to protect it.

We must wait for further details and for results before any judgment can be passed upon the merit of the furnace. We may mention however, that the original proposition related solely to the treatment of copper ore or concentrate in one operation, it being tried at Garfield in this way, the object there being to avoid the roasting of silicious concentrate, and that the advantage claimed for the process as regards zinc-bearing material was an after-thought. It is obvious therefore that the pro-

cess as now advertised in the press is in the nature of a compromise. From the point of view of the continuous process, comparisons with the Baggalley and the Knutsen processes are desirable, and reference should also be made to another revolving furnace now on trial in Oregon. As regards the function of the furnace in the removal of the zinc, there is no reason to believe that the furnace will do better work than a blast-furnace with a low column of charge. Finally, our opinion is that to attempt to conduct two different sets of reactions in one machine will tend to cripple the efforts to secure the most favourable condition for each.

Royal School of Mines.

On the occasion of the recent distribution of diplomas and prizes, by the Earl of Halsbury, a new medal was awarded in commemoration of the late Bennett H. Brough. This memorial medal is the result of an effort made by the friends of Brough, of whom there are many. It is awarded for excellence in mine surveying to students taking the full associate-ship course in the Royal School of Mines. The first recipients are Mr. L. C. Hill, son of the late Alexander Hill, and Mr. H. Eyden. Unfortunately, but not inappropriately, both of these graduates were absent at the prize-giving, one being at the Rio Tinto mine and the other at the Ooregum. It will be remembered that Brough wrote the standard textbook on mine surveying, so that the medal, of which we give a front and back photographic impression, is a fitting reminder, to the younger men, of one of the most worthy and useful of the associates of the Royal School of Mines.

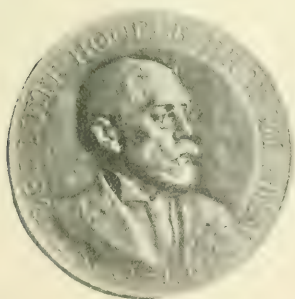
We take the opportunity to refer also to the annual dinner of the Union. This was a most pleasant affair. Among the recollections that survive from an agreeable evening is the excellence of the speeches made by the three students who proposed toasts, namely, Messrs. G. S. M. Taylor, H. R. Ruggles-Brise, and E. G. D. Wright. Another point worthy of

record is a suggestion made by the chairman, Mr. F. W. Harbord. He drew attention to the desirability of bringing the students into touch with experienced practitioners from various parts of the world by means of infor-

honoured guests, whose attendance would be regarded as a compliment to the speaker. The idea is particularly suited to London, which draws engineers from the remotest corners of the globe, giving the students a chance to hear men talk on every branch of mining and metallurgy, and to become acquainted with the distinguished members of a profession to which they expect to belong.



mal lectures to be given by engineers visiting London. This idea has been put into effect for many years, and most successfully, at the Columbia and California schools of mines.



We would suggest that the visiting engineer should not be asked to give a formal lecture, which to most men is an ordeal not to be undergone voluntarily, but an informal talk, preferably in the evening, so that it may not interfere with the regular work of the students. The arrangements should be entirely in the hands of the students themselves, but the professors should be present, if convenient, as

Another Group.

In our last issue we referred to the new combination of financiers and engineers operating in the name of the Lake View & Oroya Exploration Company. At the time when our November issue was in the press, the proceedings at another public meeting of a mining company foreshadowed the formation of another financial house. We refer to the group in control of the management of the Camp Bird, Santa Gertrudis, and Messina mines. At the time, in 1902, when the Camp Bird mine, in Colorado, was acquired by a British company, the dominant persons were Messrs. F. W. Baker and John Hays Hammond. The first chairman was Mr. Arthur M. Grenfell, of Chaplin, Milne, Grenfell & Co., and the directors were Messrs. W. F. Fisher, R. J. Frecheville, J. S. P. Samborne, and F. W. Baker. Mr. Hammond was consulting engineer. His connection with the company ceased in February 1911. Mr. Fisher resigned a year ago because he found himself in friendly disagreement with his colleagues in regard to the financial policy. What he feared did not happen, but his resignation lost the company a director of the highest type. In his place, Mr. R. N. Grenfell, a brother of the chairman, was selected. This went further to strengthen the power of the chairman, whose ability and enterprise have become increasingly manifest, until his personality dominates the control. Mr. Samborne is a mining engineer no longer in active practice owing to having been crippled in an accident. He is said to possess

good judgment and a wide grasp of the technology of his profession, and, as such, must be a valuable advisor to Mr. Grenfell, with whom he is closely associated. Mr. Frecheville is consulting engineer, as well as a director, of the Camp Bird company. He is a veteran in the happy possession of a reputation that needs no endorsement. His wide experience was applied also to the Messina. This promising copper mine in the Transvaal was acquired by the Messina Development company in January 1905. The chairman is Mr. Arthur Grenfell, assisted by a board that includes Messrs. Samborne, Frecheville, and J. P. Grenfell, the last being another brother of the chairman and the actual originator of this particular undertaking. In January 1910, the Camp Bird company, recognizing that the parent mine was approaching the stage of exhaustion, after a brilliant life, took steps to find fresh property. First, the La Blanca mine, at Pachuca, Mexico, was taken under option, but the terms proving prohibitive, attention was diverted to its neighbour, the Santa Gertrudis. An exhaustive examination preceded the acquisition of this property. Thereupon a subsidiary company, called the Santa Gertrudis, was formed. Of this also Mr. Arthur Grenfell is chairman; his colleagues on the board being the same as those in the Camp Bird directorate. Thus the Camp Bird became the holding company for the control of the Santa Gertrudis. In 1911 a large block of Camp Bird shares was placed in Paris; in consequence of this transfer the Count de Rivaud and Mr. Leon Clerc became directors, to represent the French interest. In March of this year the Messina company made an issue of £250,000 in 6% debentures, the interest for 5 years being guaranteed by the Camp Bird company, which received a commission of £2000 and an option for three years on 125,000 Messina shares at par. This was the first direct interbreeding between the companies and it has proved satisfactory to all concerned. At the time of the

Santa Gertrudis flotation the financial skill of chairman had been illustrated by the guarantee of shares by the Canadian Agency, with which two of the brothers Grenfell and also Mr. Samborne are identified. It is a firm devoted to the promotion of Canadian and other business. Again, when the Camp Bird issued debentures, a half of the underwriting was done by the Canadian Agency. We criticized these dealings in November 1911, and we still think that, however open and above-board they may have been, it is extremely unsafe for those who serve as trustees for shareholders also to act as brokers in their own interest. In some instances, as in the Messina debentures, it may prove profitable to all concerned, but it is a dangerous business, and at best can only be made less dangerous by complete frankness in every transaction. This, to our mind, is the only criticism to be made on the operations of this group. Mr. Hammond's large commission in the Santa Gertrudis deal, while he was receiving a salary as the company's consulting engineer, was something more than a blunder, but, as it has become generally recognized as such, it is not likely to serve as a precedent. The Santa Gertrudis was acquired on an appraisal that we deem to have been sanguine, but the development of the mine has confirmed, even if it has not entirely justified, the optimistic estimates of ore. The Camp Bird has proved one of the most satisfactory mining issues ever made in London. The Messina is undoubtedly a copper mine of much promise. Another property in Mexico is now under option. This is the La Noria, near Sombrerete, in Zacatecas. It is a big silver mine, the appraisal of which has delayed negotiations. A further investigation is being made under the terms of a working option. If this mine is not acquired, judicious search will be made elsewhere for promising business, leading to further financial dealings that will tend to increase the importance of this particular group. It possesses many of the elements

essential to success. The chairman has an engaging personality and unquestioned ability. His Stock Exchange connections are powerful. As regards technical advice, such as is essential to the business of purchasing and controlling mines, he is well supported. We have referred to Messrs. Frecheville and Samborne. In addition, we may mention another engineer connected with Grenfell enterprise, namely, Mr. W. J. Cox, formerly manager of the Camp Bird and now consulting engineer to the Santa Gertrudis. Mr. Cox may not be so well known in London as some of the others, but in the parts where he has lived and worked he is regarded as one of the most reliable of men. From the distant days when he was manager of the Mollie Gibson, at Aspen, throughout his management of the Camp Bird, down to his recent connection with the Santa Gertrudis, he has exhibited a reasonable caution and a sound sense that have inspired a confidence never misplaced. He is no longer a youngster, but he is still one of the quick assets of the group whose affairs we are discussing. There is also Mr. Hugh Rose, who, like Mr. Cox, has been long associated with Mr. Cortlandt E. Palmer, an American engineer prominent in Colorado before he moved his office to New York. Mr. Rose has been resident manager of the Santa Gertrudis for three years and he is said to have directed its affairs with marked ability. As regards the Messina, the manager is Mr. J. M. Calderwood, an engineer not well known outside South Africa, but there regarded as a man of undoubted capacity. Thus the members of the Grenfell group have on their staff an adequate supply of technical ability and mining experience. We wish them success, as we do to all who treat mining as a legitimate industry, and not as merely supplying counters for a gamble. We shall remind them, however, as we did our friends of the Lake View and Oroya Exploration, that in the last resort the public finds the money for mining com-

panies, and if the latter expect the continued support of the public they must run a fair game, they must be content with the regular percentage, and they must give a square deal.

Phantom Profits.

We come to the conclusion of our series of articles on this subject. Continuing the review of the discussion, it will have been noted that Mr. Ernst Lichtenberg assumes that "most engineers, in compiling the estimated cost of future operations, would include an estimate to cover London expenses, depreciation, development redemption, insurances, taxes, and so forth." We take this to be a pious hope, rather than a conviction. Mr. Lichtenberg may do so, but most engineers do not. They leave it to the directors or to their clients to make the necessary additions, considering such refinements outside their scope. In consequence, the addition or correction is never made. Things left to others are rarely done. Things taken for granted are usually overlooked. Of course, an engineer should include these items in the final estimate by which he arrives at the net resultant profit—that ultimate return on which the capitalization is based, and on which the whole character of the enterprise depends. Both Mr. Lichtenberg and Mr. H. S. Denny come to the logical conclusion that the true profit yielded by a mining enterprise is the sum total of money returned to the shareholders after allowing for amortization of capital. Mr. Denny falls back upon his wide experience of Rand mining and shows a keen appreciation of essentials. He agrees with us that behind the custom of issuing tinted statements is the desire of directors "to dress their wares in as attractive a fashion as possible"; in plain words, to boost the shares or to appreciate the property. As regards development redemption, plant redemption, and amortization of capital, these, we admit, are difficult when applied to an asset that is essentially variable,

when not wasting. Hence, unless the matter is tackled fairly and squarely, it leads to all sorts of false positions and fallacious assumptions. "Mining is not a banking business," as Mr. Denny says. Neither is it a faro game or a three-card trick. The difficulty of making financial statements truly expressing the current position of a mining enterprise and the equal difficulty of estimating the ore-assets at any given date are appreciated by no one more than by ourselves, for we do not write academically but after having been saturated in experience of the vicissitudes of mining. We recognize the difficulties, as we have said, and that is why we insist that the only way to overcome them is not to make two and two into five, or to guess twice and divide by two for accuracy's sake, but to look facts in the face, discarding make-believe, and rejecting the futile effort to evade the economic truth. Thus we arrive finally at the fundamental conception of the profit earned by a mine as the total sum of money returned to its owners over and above the capital consumed. Therefore, in appraising future profits, the engineer must estimate the life of the mine and the contingencies incidental thereto, especially such as are likely to affect profitable production during that period. If he does not do so, or cannot do so, he has failed in giving a trustworthy valuation. The case is analogous to that of the man who examines a mine: if he takes his samples at regular intervals, reduces them, assays them, and records the results on a map, he has only begun to do his work. The next step is the more important and requires more experience, namely, to make correct inferences from the sampling. To do this he must project his mind forward and realize how the mine is to be worked. If he finds an average of 2 feet of 2 oz. gold ore and assumes that it will be broken, as in sampling, to a width of two feet of clean ore, he fools himself. It may be that the vein can be 'resued' by single hand to a narrow width of clean ore,

but, more probably, it will be machine-stopped to a width of about four feet, reducing the grade to nearly one-half. He must ascertain whether the additional two feet is barren or only poor, and how poor. He must have sufficient experience of local conditions, or of others like them, to estimate the proportion of sorting practicable, either in the mine or at surface. He must have an idea of how much ore goes to the mill and how much to the smelter; and if to the smelter, what charges will be levied. In this case, as in others arising in the valuation and management of mines, it is necessary to see beyond the point of the pencil. So that we return finally to the idea of profit as an item to be determined not by the accountant, who is only a conventional arithmetician, nor by the director, who is not responsible for technical details, but by the engineer, on whom devolves the duty of stating facts so that they may be understood beyond peradventure.

Consolidated Oil Fields.

The search for oil is now an important branch of mining, and in so far as it involves the application of geology to prospecting it illustrates the aid of science to industry. In short, it is a serious business. Hence we protest when it is brought to ridicule by the vagaries of reckless finance. During November the newspapers of London were made the medium of a big advertisement of the Consolidated Oil Fields of South Africa. The name provokes suspicion; it is too much like that of the Consolidated Gold Fields of South Africa. We wonder why it was passed by the authorities at Somerset House, where care is usually taken to prevent confusion or imposition by the christening of financial bantlings under names too closely resembling those already established. The office of the Oil Fields, like that of the Gold Fields, is in Old Jewry; this is another false analogy. In other respects the prospectus is not only unsatisfac-

tory: it exemplifies nearly everything that a prospectus should not be. It is an absurd anachronism to publish such a document at the end of 1912, for the day has gone for such a performance. None of the directors are known to us as experienced in mining affairs. The terms of the business are ludicrous. The capital is £250,000, of which the South African Petroleum Exploration Syndicate now offers 50,000 at par, namely, £1 per share. These shares, if taken by the public, are to help the Syndicate to re-imburse itself for the £50,000 guaranteed by it as working capital. In return for this guarantee, which is promptly passed to the public, the syndicate receives 249,900 of the £1 shares. Thus the syndicate will hold four-fifths of the share capital and the public will have found all the money. Moreover, the syndicate takes a modest royalty of 10%, in further recognition of its valuable services. This is financial effrontery. Whereupon, as if to give a proper touch to the shameless performance, the scheme is cordially endorsed by that farceur *John Bull*, in the pages of which it has been boomed systematically. According to that impudent periodical this "constitutes the most attractive financial scheme we have come across for many a day." The £1 shares are said to be likely to reach £5 in a few months' time. All we care to say is that those who believe it had better read another page of *John Bull* on which an article appears under the heading 'De Lunatico Inquirendo.' Surely it is late in the day for such a trespass on public credulity. The so-called synopsis of reports includes alleged statements by General Botha, Sir Boverton Redwood, a farmer, the mayor of Kimberley, an editor, a former subordinate of a geological survey, and sundry non-descripts. Sir Boverton Redwood has written to state that his remark was made concerning a piece of rock of unknown origin submitted to him in 1904 and that the sample was not favourable to the occurrence of more than the

small quantity of petroleum described as having been found in it. This is the opinion of the only man whose opinion is worth even a mention among those appearing in the prospectus. General Botha's opinion on an oil venture is worth as much as his opinion on the canals in Mars. It was an impertinence to use his name in such a context. The evidence of oil is negligible. We conclude that the enterprise, like the scum on the stagnant water, is only the iridescent film of finance.

Criticism.

Occasionally we are aware of the fact that our criticism of company administration is assumed in some quarters to be vindictive or malign; still more rarely we receive a letter from some mine manager protesting against attack on the enterprise with which he is connected. A recent episode, of no great moment, but typical, gives an excuse for referring to a matter that is delicate but interesting. Of course, the independent criticism appearing in a technical publication such as this magazine cannot but be annoying to those who would prefer a kindly silence. Equally, of course, the editor would be renegade to his duty, as a public critic, if he avoided the unpleasant task of hitting at performances that discredit the industry of mining. Fortunately a test exists whereby such criticism can be gauged, namely, the judgment of the engineering profession. If, for example, we attack the maladministration of the Great Blank Company unfairly or inaccurately we expect to hear from the engineers or metallurgists in that company's employ. We expect them to say that they will no longer give their support to a publication that is reckless or malicious. On the other hand, if we criticize the chairman or directorate of a company when one or the other deserves reprobation, or protest against methods obviously reprehensible, then we expect, and receive, the approval, not often expressed at the time, even of the most loyal

members of the staff of the very company or control under arraignment. The engineers on the staff of a mining company that is run merely for market purposes or to suit the share-dealings of the controlling director suffer from the queer doings that ensue, and they are glad when such performances are rendered increasingly difficult. Moreover, every time that money is made by nefarious methods, the success of the method diminishes the value of the professional services of the man unwilling to comply with the requirements of a subsequent performance of a similar kind. To put it in a nutshell, when rogues prosper honest men are at a discount. We want to make it increasingly difficult for the venal engineer and the crooked operator to make money out of the public, and thereby to make it easier for an honourable engineer or an honest operator to make a comfortable livelihood. Or, to put it in another way, we want to see a minimum of money distributed among unprofitable mines and untrustworthy operators, in order that the maximum amount of money may be available for profitable mines and trustworthy operators. Every bad scheme and every crooked enterprise not only transfers money from the innocent many to the slim few—a process that is inevitable, in any case—but it destroys the confidence on which industry depends for financial nourishment. Mining is speculative, and like all speculative business it lends itself occasionally to chicanery; the more chicanery flourishes the less will be the public support for a speculative business that is the life-blood of something even better and bigger, namely, a world-wide industry.

One deterrent to chicanery is public opprobrium; the other is lack of success. Both may ensue when wrongful scheming is attacked and dissected. Such work on the part of an editor, wholly detached from the game, as he must be, is not a pleasure; it is a distasteful duty to which he is driven despite himself. Occasionally a sense of humour may

lessen the distaste, but then it is apt to add to the irritation inevitably occasioned. Indeed, it would not be worth while if it were not certain that it was useful. Whenever we suspect such criticism to serve no useful purpose, we shall desist, and this magazine will go the way of many another publishing enterprise. But the funeral, we are glad to add, is indefinitely postponed. We have a cheerful conviction that good work is being done. In a recent letter a managing director of high standing, but not known to us personally, writes to say: "Though we sometimes get angry under criticism, the general and well informed criticism of your magazine is felt to be a help by nearly every sensible director, and will in due course bring about a reform in many an honestly directed enterprise." *Sufficit.*

Consolidated Gold Fields.

Lord Harris made the best of a bad job. In a tactful way, as chairman at the recent annual meeting, he anticipated many obvious criticisms and if he did not offer a complete reply he said enough to dull the edge of further animadversion, at least from his own shareholders. "Disappointing, but not discouraging," he dubbed the financial statement. We might let it go at that, but the performances of a trust company like the Consolidated Gold Fields of South Africa call for more serious comment, having regard to the possible example it sets to other financial corporations. Of course, the lack of information given to the shareholders is a prominent fact. Since 1910 no schedule of the company's shareholdings has been issued and receipts are so lumped together as to obscure the various sources of revenue. Meanwhile it is made clear that the speculation in shares constitutes a large part of the business, for last year these market operations yielded a profit of £200,000, after allowing for losses aggregating £10,000. Apparently the shareholders are expected to leave their money in the hands of the direc-

tors, to be used by the latter as they see fit, and without asking inconvenient questions, that is, questions that might give away the game to rival operators in the same market. Such a view of the relation between the directors of a financial company and its shareholders may commend itself to some of our readers, but to others it will appear highly objectionable. To us, as onlookers, it seems unwise and undesirable that the directors of a public company should give so slight an account of their stewardship. The board of the Gold Fields is hardly entitled to special indulgence. We would deem it foolish to give Lord Harris and his coadjutors a blank cheque for a large sum to be used by them in an investment in mines or even a gamble in mining shares. No obvious reason exists for believing that they could make better use of our money than other agencies more willing to keep us fully informed concerning the use made of that money and of the interim progress of the mines in which that money was involved. It is not a question of honesty or honour; that does not arise. It is a question first of secrecy, and then of capacity. The secrecy is objectionable, the capacity is questionable. We instance the Shamva. That big low-grade enterprise has been over-valued from the very beginning, the reports have been obscure and incomplete, and the results will fail to sustain the market valuation, which is based on official information that has misled many people. The 500,000 shares were kited to £5½ when the mine was merely a big prospect. Even the 2¼ million tons represents gold having a gross value of only £2,323,513, from which a net resultant profit may be expected of not more than £1,000,000, as against the £2,687,500 at which the mine was valued in 1910 or the £2,200,000 at which it is now appraised. This means that at the present moment over 2 millions is sunk in the Shamva on the assurance of receiving £1,000,000; that is, taking the facts as known, the shareholders today

stand to lose half of their capital and all the interest on that capital until such time as the adventure is ended. The plain inference is that although the Shamva will be, for several years, a highly productive property, it will cause a large loss of money to those backers of the Gold Fields who have, on the strength of the statements issued from the Gold Fields and the Shamva offices, been led to suppose that the mine could make a handsome return on the capital involved. Concerning the other Rhodesian ventures controlled by this company, we regret to have been compelled repeatedly to condemn the cryptic manner in which information is given to the public. Lord Harris may see no scandal in this, as he sees no scandal in the Anglo-Continental share-dealings, but we think that he is mistaken in supposing that the good name of the Gold Fields has not suffered. It has suffered in repute not because it has had some bad luck in the last year or two, but because it has failed to recognize its obligations as a trust company. As a financial institution it rests upon a foundation of public support, first from its shareholders and then the general public. With that support is entailed the responsibility of a trustee. That responsibility appears to us to have been ignored.

Stripping Frozen Gravel.

In preceding articles, published in these columns, we have described the successive stages whereby the mining of the frozen gravel deposits of the North has been advanced, from the method of thawing by wood-fires to that of softening by steam. We now come to the latest step in the technology of the subject. It will be remembered that the placers of Siberia, the Yukon, and Alaska, are covered by an insulating blanket of moss called 'tundra,' a Russian word originating in Siberia. Under the tundra comes a layer of frozen vegetal matter, which the miner calls 'muck,' not having been able to select a more signifi-

cant term. This black under-blanket when exposed to the summer sun or to artificial heat disintegrates into a thin mud that floats readily on the running stream, for 25 to 40% of it is organic matter. The thickness of this vegetal material varies from a few inches to 40 feet, the maximum being found in gullies where it has accumulated by sliding from adjoining hillsides. Two feet is the average thickness. Whether thick or thin, this insulating layer, with the top covering of moss, together constituting the 'tundra,' must be removed before the seasonal thaw can begin. This is done in places and naturally by freshets or meandering streams; it can be done systematically and artificially by ground-slucing and hydraulicking. Once the frozen gravel is exposed to the sun, it will thaw rapidly. The summer, meaning the interval free from frost, lasts about 120 days. During that time the temperature is relatively high, rising to 90°F. Then the surface thaws freely, turning the tundra into a quaking morass. It must be remembered that the deep penetration of the frost is due not to the ordinary effect of winters, however severe, but to a Glacial period, that is, a time when the cold was so excessive that the summer thaw failed to overtake the winter frost. The seasonal frost, as measured on ground that has thawed during summer, reaches down 3 to 6 feet, the distance depending largely upon the early snow-fall, but the geologic frost extends to a depth of 230 feet, if not more, wherever the rock is wet. Moisture, of course, is the decisive factor. Ground once thoroughly drained does not freeze. On the other hand, the seasonal thaw, during the four months of kindly sunshine, will reach to a depth ranging from 4 to 8 feet, according to local conditions, the chief of which is the nature of the covering. It is apparent, therefore, that in spots where the frost happens to be at its maximum and the thaw at its minimum, the former will prove dominant; but this is rare. On the contrary, it has been as-

certained that in two summers the frost in a gravel deposit that has been drained may be conquered by the natural thaw to a depth of from 12 to 16 feet. Even in the coldest winter, such as that of 1905, when the thermometer registered a minimum of -71°F , the frost did not overtake the previous summer thaw, on ground that had been stripped, by fully three feet. Thus, where bedrock is not more than 12 to 16 feet deep, and time does not press, it is practicable to thaw the frozen alluvium to bedrock in two seasons by simply removing the overburden of moss and mould so that the summer warmth may get a chance to penetrate. This is the natural fact underlying a new technical procedure.

Thawing by steam is relatively rapid, but it is costly. As we have stated in a preceding article, the average cost is about 8 pence per yard of ground, including the tundra. Even when employing this artificial method it is advisable, before dredging begins, to remove the brush and undergrowth distributed over the placer deposit to be exploited. But dredging follows in the immediate wake of the steam-points, so that time is saved, as compared with natural thawing. When the summer sun is utilized to thaw the ground instead of artificial heat, it is necessary to lose from one-half to two seasons of productive operations, depending upon the thickness of the deposit. Once the ground has been stripped and lies exposed to the sun, it will be thawed to the average depth of the alluvium in two seasons, that is, in the Klondyke district. Thus it becomes simply a financial question whether it is cheaper to thaw with steam-points concurrently with dredging or to allow two seasons, entailing two calendar years, for the same result to be attained by natural means. The problem can be stated thus: An acre of gravel 18 feet deep contains 27,649 cubic yards; if thawed by steam the cost is about £920. If thawed slowly by exposure to the sun, the loss of two years at 5% on £2304

equals £115 per annum or £230 altogether. As compared with steam-thawing, this is cheaper by about £690, or 6d. per cubic yard, up to a depth of about 18 feet. In practice the full difference may not be gained because in parts of the area the gravel may be so deep or otherwise so conditioned as to necessitate the aid of the steam-points to prepare the ground thoroughly for digging by a dredge. It may also be explained that the dredge has to remove the barren overburden of tundra, at a cost ranging from 3 to 7 pence per yard, that under the other system is washed away by ground-slucing at a cost of from 3 to 5 pence per yard, the higher cost obtaining where the ground is shallow. If, however, cheap electric power is available, as is the case now on several properties, it becomes economical to use a relatively small volume of water under pressure, by pumping it through a nozzle, because the spray will displace the mossy debris that tends to hinder the further thawing by protecting the surface of the frozen gravel. The cost of stripping by hydraulicking as compared with that of ground-slucing does not differ greatly, the main factor in making a choice being the supply of water available. A small supply under pressure will perform as much work as a large supply without the aid of pressure. In parts of Alaska it is the practice to employ scrapers and ploughs in the work of stripping. At the Pioneer mine, near Nome, a so-called caterpillar or traction engine drawing a series of ploughs is employed preparatory to hydraulicking. The actual method to be selected must depend upon local circumstances, the basic idea underlying this latest development in the mining of frozen gravel being the use of natural heat in the thawing of an alluvium that was frozen by the rigours of a bygone geologic period. The technology is interesting, we trust, and it is undoubtedly important as aiding the exploitation of gold-bearing gravel throughout the sub-Arctic regions of Asia and America.

Editors and Secretaries.

We note that the affairs of the American Institute of Mining Engineers have received much prominence in the technical Press on the other side of the stretch of sea that unites us to America. Despite keen interest in the controversy, not all of it friendly, that has temporarily beclouded that famous organization, we have abstained from direct comment, believing that a settlement could be best attained if too many critics, especially those living at a distance, did not participate. We have, however, discussed the function of the Institute, and others like it, as a publisher. As cognate to that topic, we may mention the suggestion that the new secretary should be a business man, who will leave the editorial work to a reading committee, resembling the referees to whom papers are submitted by the secretary of the Institution in London. This is a matter on which we feel competent to express decisive opinions, with frankness. Of course, the American Institute achieved distinction and usefulness by reason of the fact that its secretary—for 27 years—was Dr. R. W. Raymond, whom most of the cognoscenti recognize as the most competent editor known to English technical literature. In consequence of his personal influence, the Institute for many years received the pick of the technical papers written by engineers and geologists; and by his subsequent skilful revision of those papers he made the transactions of the American Institute a reference library in mining and metallurgy. This result was not obtained without neglecting some of the other obvious functions of the Institute and not without a diversion of attention from its business management. Hence the recent trouble. The point that we make is that the secretary was an editor, *facile princeps*, rather than a business man. Now the idea is to swing the other way, sacrificing the literary revision to the business management. It is an old and iterative problem. Every technical society

faces it periodically. Here in London it is solved fairly satisfactorily. The Institution has for secretary an efficient and tactful man of affairs, with a kindly feeling for, rather than an accurate knowledge of, technology. The selection of papers is left largely to a sub-committee of the Publications Committee, itself a sub-committee of the Council, which is an unwieldy aggregate of 43 persons. A paper when submitted by its author is sent to the referees, usually three, who state whether it should be published and suggest emendation or amplification of parts. They do not revise or edit. The Institution has three honorary editors, of whom it is kind to assume that they accept the honour without the responsibility, for the papers as published undergo no serious editing and but hasty proof-reading. Thus the Institution in London today offers an effective contrast to the Institute in New York, as it was under Dr. Raymond, for the one has excellent management and no real editing of papers, while the other was incomparably strong in the literary function while weak in the business sphere. The question arises as to whether it is possible for such a society to be strong in both departments. Obviously, Yes; if the revenue is adequate to meet the cost. Of course, efficient men expect, and get, large salaries. As no individual is likely to possess both the attributes of a literary and of a business man, it becomes necessary to pay two salaries. At present each society pays one salary, in the one case to an editor, in the other to a general manager. If the American Institute reverses its record and chooses henceforth to have a business man for secretary, leaving the revision of papers to an honorary committee of members, it will have made a fundamental change. Its administration will more nearly resemble that of the Institution here. But if the change is made, the Institute can say a long farewell to its status as a publisher of technical literature. Without being unkind, we can say frankly that the

Institution here fails lamentably as a publisher while it succeeds admirably as a professional organization. The average level of excellence attained by the papers submitted to it is not high, and even the best ones suffer from lack of revision and from careless proof-reading. A good technical article, if not voluminous, obtains a quicker and wider reading in the technical journals, where a professional editor revises the manuscript and practised eyes scan the proofs. The fact is, as we have said before, the day is gone for technical societies to perform the functions of publishing current professional writings. That is done better by the agencies that make a specialty of it. But it may be too soon for our American friends, quick in all else, to apprehend the fact. They will want to maintain the status of the Institute as it was made by Dr. Raymond. Then let them have a secretary who is a technical man and an editor. Let them, as democrats, put their trust even in princes before they consign manuscript to an honorary committee. Of the many things that committees can do inefficiently, editing is one. Of course, a single paper may be referred to an individual, but all the individuals composing one committee, or the many committees that may be selected in rotation, will not act with the singleness of purpose and the concentrated acumen of a Raymond. Not for a minute: they will lack the authority, the continuity of work, and most of all, the ability needed for such a specialized function. You can make a committee by a show of hands, but you cannot make an editor. He is the result of long and persevering application to a kind of work that most people, especially amateurs, find too exacting. We say this frankly, hoping it may help our friends in New York when they arrive at a decision so momentous to the future of the American Institute to which we feel kindly for the sake of the good old times as well as for those that we hope are yet to come.

PERSONAL

A. H. ACKERMANN returned to Rhodesia on November 30.

HANS C. BEHR, who has resigned as chief mechanical engineer to the Consolidated Gold Fields, is in London.

H. C. BELLINGER, of Cobar, is intending to visit this country and the United States.

GEORGE H. BLAKEMORE has returned to Australia after an extended trip round the world.

FREDERICK K. BRUNTON, for some years in the research department of the Amalgamated Copper Co., has just been appointed Assistant Superintendent of the British Columbia Copper Co.'s smelter, at Greenwood.

J. M. CALDERWOOD left London on November 30 on his return to South Africa.

J. E. CARNE has been investigating oil lands in Papua on behalf of the Australian government.

J. PARKE CHANNING, recently in the Caspian oilfield, sailed for New York on December 14.

JOHN COOPER has returned from Zacatecas, Mexico, to Exeter.

G. S. CORSTORPHINE is consulting geologist to the Giant Mines of Rhodesia.

JAMES CROZIER has been appointed superintendent for the Cape Copper Company.

GORDON DICKSON is engineer to the Cam & Motor Mining Co.

SIDNEY DYER has been appointed consulting engineer to the Amalgamated Properties of Rhodesia.

CHARLES EGAN is now in Spain.

W. R. FELDTMANN has returned from a periodical visit to Ashanti.

R. J. FRECHEVILLE sailed on December 7 for New York.

T. J. GREENWAY, for some years with the Potter Sulphide Ore Treatment Co., has resumed private practice at Melbourne.

ANDRE P. GRIFFITHS has returned from Madagascar.

FREDERICK HELLMANN has been appointed general manager of the Chuquicamata mines, near Calama, in Chile, for the Guggenheim Exploration Company.

AUGUST O. HOFFMANN, formerly identified with the Sissert mines, was in London recently.

ROSS B. HOFFMANN is expected from Nicolaievsk.

JOSEPH A. HOLMES, chief of the United States Bureau of Mines, has gone to Panama.

EDWIN HOMERSHAM has opened an office as consulting engineer at 33 Broad Street Avenue, Blomfield Street, London.

THOMAS HUNTINGTON and ALEXANDER STEWART are the technical advisers as to the treatment of the ores of the Bwana M'Kubwa Copper company.

W. M. KNOX arrived recently from Nicolaievsk, on his way to San Francisco.

KNOX & ALLEN are consulting engineers to the San Francisco del Oro Mining Co.

C. E. KNECHT has been appointed consulting engineer to the Consolidated Mines Selection company.

A. F. KUEHN has returned from Norway.

C. H. MACNUTT was at San Francisco recently and is now in Arizona.

W. A. MACLEOD is general manager in Western Australia for Bewick, Moreing & Co.

J. MALCOLM MACLAREN goes to Burma in January.

J. E. MCALLISTER sailed for New York on November 30.

J. L. MENNELL sailed at the end of November for Valparaiso.

C. A. O'CONNELL is now manager of the Tough-Oakes mine, near Swastika, Ontario.

FRANK H. PROBERT has been appointed consulting engineer to the Shannon Copper Co., Arizona.

ARTHUR J. RUSSELL, managing director of the Tolima mine, is on his way to Colombia.

W. J. SHEPARD is manager of the South Bukeru tin prospects in Nigeria.

A. SMART has taken an office at 5 London Wall Buildings, E.C.

EDWARD A. SMITH is on his return journey to Mexico.

R. H. STEWART, general manager for the Consolidated Mining & Smelting Co., has returned to Trail from his visit to London.

M. T. TAYLOR, recently manager of the Great Fitzroy, has been appointed manager of the Phoenix mine, Cornwall.

H. BISSELL THOMAS has returned to Wembley from Russia.

JOHN THOMSON has returned from Northern Nigeria.

W. E. THORNE has returned from investigating placer ground in Portugal.

J. B. TYRRELL is on his way from Toronto to London.

JAMES WALKER has joined the firm of Boving & Co.

W. FISCHER WILKINSON is paying a short visit to the United States.

ERNEST R. WOAKES was recently in Spain.

METAL MARKETS

COPPER.

Average price of cash standard copper :

Nov. 1912	Oct. 1912	Nov. 1911
£77. 0s. 0d.	£76. 10s. 7d.	£57. 8s. 4d.

Anxiety with regard to the political outlook is mainly responsible for the unsettled state of the standard copper market. The actual condition of industry among copper consumers is one of unabated activity, but the menace to European peace in connection with the Balkan dispute is inducing buyers to proceed with rigid conservatism. Exports from America accordingly show a heavy decline, although the end of the month brought an improvement again in this respect. In some quarters this is attributed to the difficulty of obtaining freight accommodation, but the explanation is hardly satisfactory, as the scarcity in tonnage was quite as great when large quantities were being shipped. European stocks, however, continue to dwindle, and every delivery from store creates a greater demand here for the American product. Further railway-electrification schemes are afoot, and the present warlike activity is extending the use of the metal on armaments. Speculation is for the moment dormant, the public being discouraged by uncertainties both political and financial. These once over, a fresh buying movement is likely to develop. Consumers appear to be buying from hand to mouth, lulled no doubt by the steadiness in the price of American producers ; their danger appears to be that when they come forward to buy, the material may no longer be available in sufficient quantity.

The American Copper Producers' figures for November show a decrease of production of 4800 tons and a decrease in domestic deliveries of 6500 tons ; on the other hand, exports were 3600 tons greater, and the stock at the end of the month 4200 tons higher.

TIN.

Average price of cash standard tin :

Nov. 1912	Oct. 1912	Nov. 1911
£227. 16s. 10d.	£228. 9s. 1d.	£194. 19s. 4d.

The market has been comparatively steady. Before the Banka sale, prices were somewhat depressed, to recover again as usual later, but the movement was of little extent. Welsh consumers complain that the war is interfering seriously with orders, while American demand is light. At the Banka sale, 2685 tons was sold at an average price of £226. 15s. In

view of the general unsettlement, the course of the market must be considered satisfactory. There is no fundamental change in the position of the metal, and with a return to normal conditions a continued large consumption is to be expected. Supplies are not keeping pace with the large requirements of the world.

LEAD.

Average price of soft foreign lead :

Nov. 1912	Oct. 1912	Nov. 1911
£18. 4s. 7d.	£20. 8s. 0d.	£15. 15s. 5d.

A further fall in prices has taken place. Consumers show themselves confident in expecting still lower prices, and refuse to buy except for early delivery. They complain that the high price is checking consumption, while the movement of interested parties to restrict the use of the metal in the manufacture of white lead is making users cautious in buying forward. Some good export orders have been given. Consumption is good for this time of year.

SPELTER.

Average prices of good ordinary brands :

Nov. 1912	Oct. 1912	Nov. 1911
£26. 14s. 3d.	£27. 5s. 10d.	£26. 13s. 2d.

Following a fall in the London quotation, the syndicate has cut prices about £2 per ton. Such a reduction was unexpected and has led to heavy purchases by the trade. Prices have consequently been advanced again 5s., and even at the higher prices, considerable business has been placed. The exportation of galvanized iron has reached record figures.

OTHER METALS AND MINERALS.

Prices quoted on December 10 :

SILVER.—29½d. per oz.

PLATINUM.—185s. per oz.

BISMUTH.—7s. 6d. per lb.

CADMIUM.—3s. 3d. per lb.

ALUMINIUM.—£85 to £88 per ton.

NICKEL.—£170 per ton.

ANTIMONY.—£38 to £40 per ton.

QUICKSILVER.—£7. 8s. 6d. per flask.

MANGANESE ORE.—10d. to 1s. 0½d. per unit (1%).

IRON ORE.—Cumberland hematite 26s. 6d. per ton at mine. Spanish 23s. delivered in England.

PIG IRON.—Cleveland 68s. per ton. Hematite 80s. per ton.

WOLFRAM ORE.—33s. per unit (1%).

SPECIAL CORRESPONDENCE

News from our own Correspondents at the principal mining centres

JOHANNESBURG.

Modderfontein Deep.—This company has come into the limelight recently owing to the good ore cut in its shafts and in the workings adjacent thereto. Its mining area comprises 377½ claims, arranged in a triangle, lying between the New Modderfontein on the north, and the Government Gold Mining Areas on the south. The property is being opened up by two three-compartment shafts, only 100 ft. apart, which constitutes a novel departure in local methods of exploitation. These shafts are placed in such a way that about half the ground will be worked to the rise and half to the dip. As the area is a comparatively small one, this disposition is not likely to occasion much inconvenience as regards the dip and rise workings; but as the property extends into a sharp angle eastward, it will require about 7000 ft. of driving to reach this extreme point along the strike. This will mean, ultimately, high tramming expenses and perhaps difficult ventilation, whenever this distant area is attacked. The twin-shaft system has the merit of concentrating hoisting operations and of enabling all the surface equipment to be centrally arranged and consequently readily supervised; it also provides the necessary second outlet at once, thus eliminating long and costly connections between shafts, and shortening the time that must intervene between cutting the lode and commencing milling operations.

The lode disclosures have, so far, been most satisfactory. The section exposed in No. 1 shaft assayed 8·8 dwt. over 126½ inches of banket and quartzite; and that in No. 2 shaft, 7·8 dwt. over 47 inches of upper banket and 10·5 dwt. over 15½ inches of lower banket. In considering these good assays, however, it is well to remember that the Far East Rand is much more patchy than the Central Rand, and that a few good samples from a limited area are no guide to the richness of the ore that will be exposed in the course of more extended development. Only when a year's results are available for inspection can even a rough estimate be formed as to the resources of the property. For this reason it is extremely desirable in reviewing results such as the above not to allow either rich finds or poor ones to excite a flamboyant optimism

or a gloomy pessimism. The company has a capital of £500,000 in £1 shares, of which 263,000 have been issued, leaving 237,000 shares in reserve. At December 31, 1911, there was a credit balance of £183,314 in cash and cash assets; and the chairman stated that there would be about £100,000 available for development after the shafts were down to the lode. The financial position is therefore a fairly healthy one; and given ordinary luck in the persistence of profitable ore, the company should enjoy a satisfactory career.

First Aid.—The Chemical, Metallurgical, & Mining Society is continuing its useful work on behalf of the mining community. With an appetite whetted by success, and by the financial surplus, due to the mining exhibition it carried through early in the year, this technical society has decided to devote the balance remaining to the founding of an ambulance shield open for competition by underground workers. A joint committee of representatives of the society and of the St. John Ambulance Association was accordingly formed and the necessary rules and conditions drawn up. The joint committee at an early stage considered that the scope of the competition might well be enlarged, and it succeeded in obtaining two other shields, one for colliery workers and one for surface workers at gold mines. The competition for these three challenge shields will take place during December, and as teams can enter from any part of the Union of South Africa and Rhodesia there is every prospect of a keen and close struggle. In addition to the shields, the winning teams will receive silver medals; and the second teams will receive bronze medals, if the judges consider their work worthy of recognition. The hearty co-operation shown by the Coal Owners' Association and other organizations has been most encouraging, and everything points to the competitions assuming a national importance in the future. The underground competition is particularly opportune, as, after January 1, 1913, the mining regulations make it necessary for all mining officials to provide themselves with ambulance certificates. Apart, however, from the stimulative utility of the underground competition, these contests will have the effect of setting certain humanizing currents in motion, and experience in other

countries has shown that such humanitarian exercises have a high educative and moral, as well as an obvious practical, value.

Air-Blasts.—These undesirable manifestations of nature are beginning to attract attention locally, although they have long been familiar in deep mines in other countries. The term 'air-blast' is singularly unscientific and non-explanatory. It is a miner's, not a mining term, and as such it deals with the effect rather than with the cause. 'Strain-burst' would be a better term.

In the silver-lead mines of Pzribram, Bohemia, considerable trouble was experienced below 3000 ft. by angular fragments of rock being hurled from the face with loud detonations. In one case a piece of graywacke of about 200 lb. weight fell from the face of a drift, exploding at the same time into a number of pieces that killed one of the miners. Sometimes the stopes in this mine had to be abandoned for days owing to these strain-bursts. It was the hard fine-grained silicious layers of graywacke that were the most dangerous, the softer and coarser layers being comparatively inert. The precautions taken to protect the miners in the stopes were: immediate removal of broken rock where the walls were dangerous, followed by prompt stope-filling; and the alternate working of stopes on one shift per day only, so that equilibrium might have time to establish itself before the ground was again disturbed. Plank shields were also used, and only experienced miners were employed in the area affected. At Hillgrove, in New South Wales, drifts in a silicified slate have given great trouble owing to these occurrences; and in the gold mines of the Mysore, India, this sudden shattering has occurred both in hornblende-schist and igneous dikes, and even in the quartz veins themselves. The copper mines of Michigan, particularly the Quincy and Atlantic, have also suffered heavily from this cause. On the Rand, several mines have already experienced trouble, but the greatest sufferer so far has been the Cinderella Consolidated. In July last a succession of blasts drove the men out of six high-grade stopes, with the result that the working profit, which was £4058 in June, dropped to £104 in July. As the mines of the Rand become deeper, it is probable that sand-filling will be more and more relied upon to support the hanging wall and thus relieve the working-faces from the abnormal pressure that they have even now, in many instances, to carry.

Miners' Phthisis.—This dread disease

continues to throw a pall of gloom over the spirits of the underground workers and those dependent on them. It is no respecter of persons, and claims its victims alike from among highly educated young engineers and working miners. Indeed, it may be said that this scourge is exacting the greatest toll in human lives from among those whom the industry can least spare. The matter is now one of the gravest concern, for if thoroughly efficient remedial measures are not soon instituted there will not be many highly skilled miners left on the goldfield, and no one will be willing to learn mining in the face of such risks. Much has, of course, been done to combat the evil, but much more still remains to be done before a full solution of the problem can be said even to be in sight. The Miners' Phthisis Prevention Committee's preliminary report, which has just been published, contents itself chiefly with recommendations for the extension and stiffening of existing regulations, more thorough wetting and inspection being the main lines of attack. The penalties suggested for contravention of the regulations seem extremely mild in view of the terrible harm done by such breaches of duty. A £5 fine or the suspension of a certificate for three months is a punishment not at all commensurate with the gravity of the offence. Something more or less on the lines of the regulations relating to the possession of matches or the lighting of a pipe in the fiery coal mines of Durham, that is, imprisonment without the option of a fine, would seem to be necessary to impress the underground force with the fact that any trifling with men's lives cannot be done with impunity. The recommendation of the Committee that it be the duty of surveyors and samplers to report any contravention they notice to the manager, savours somewhat of espionage, and unless these hard-working and intelligent members of the underground staff are financially recompensed for such a disagreeable addition to their normal duties, their performance in this direction is bound to be half-hearted. One cannot expect moderately paid employees to take the risk of incurring the detestation attaching to tales out of school unless it is made worth their while. The Committee intimates that considerable amendments may be introduced in its final report; and it is to be hoped that one of these will deal with the penalties for contravention in such a way that all the world will know that in the mines of the Rand the wilful creation of dust is looked upon as a crime and not merely as a misdemeanour.

The Jumpers.—It was hoped, two years ago, to prolong the life of the Jumpers and the adjoining Treasury by working them conjointly under one management. Both are quite small mines on the outcrop. Unfortunately the remaining blocks of ore in the Jumpers have proved to be of much lower grade than was estimated, so in all probability the mine

Klerksdorp.—This district continues to lead a precarious existence; the results of the productive mines have not been, up to the present, good enough to encourage a display of optimism. The show mine, the Afrikaner, still remains shut-down; but as it contains 227,000 tons of fully developed ore, averaging 8'27 dwt. per ton, it is highly prob-



THE BEGINNING OF THE JUMPERS MINE.

will be exhausted this year. Thus an end will come to one of the original properties on the Rand, and at this distance of time there is no harm in saying that its existence as a separate entity was due, as its name implies, to the fact that several enterprising persons were aware that the survey of the Geldenhuis was faulty. The photograph reproduced on this page shows the early working of the outcrop.

able that the necessary capital will soon be found to enable it to erect a reduction plant on a scale suitable to its comparatively modest needs. The finances of the Machavie have been re-organized and a modern plant adapted to the composition of its ore is to be installed.

The remarks of the District Inspector of Mines, Colonel H. Bottomley, in his report for the year 1911, concerning the famous Cy-

ferfontein strike are worth quoting. He says: "In the latter part of 1910 the district was startled by the alleged discovery on Cyferfontein, to the immediate north of Buffelsdoorn, of a section of main reef carrying payable values in a borehole. During the year prospecting operations were vigorously prosecuted; the results, however, of such prospecting operations were absolutely negative, the curious point being that not even the reef found in the borehole was ever located either in sinking or on the outcrop. The depth of the alleged strike was 546 feet from the surface. The effects of this supposed strike were far-reaching for a time. Every available piece of ground within ten miles of the borehole, on the supposed strike were taken up, only to be abandoned when the Cyferfontein Syndicate suspended operations and went into liquidation." The official name of this concern was the Main Reef Exploration Syndicate, and its headquarters were in Johannesburg. This fiasco explains the complete lack of interest taken in the district ever since.

Mine Contracts Conciliation Board.

—The Transvaal Miners' Association has experienced difficulty after difficulty in its endeavour to secure a Conciliation Board under the Industrial Disputes Prevention Act, in connection with the new underground contract, which came into force on August 1. The first obstacle, the necessity for the disclosure of the names of all the miners applying, in order that legal technicalities might be properly observed, having been overcome, and about 800 names sent in, other objections were put forward by the mines. These took the following shape. The companies gave the proper statutory notice to such employees as would be affected by the coming into force of the new agreement as from August 1, but the miners failed to give proper notice of their desire for amendment; consequently, their application was not in order. It was also pointed out by the directors of the companies involved that the new contract was working smoothly and well and that there was no likelihood of a strike resulting should the alleged dispute be not referred to a Board of Conciliation and Investigation. As regards the names submitted, attention was drawn to the fact that some were unknown, some had left the company's employ since August 1, some had become employees since August 1, some were day's pay men, and some were not employed as miners. The Miners' Association, after a considerable amount of trouble, satisfactorily met all these objections, and 16 out of the 17

mines in respect of which the Conciliation Board was granted then appointed their two representatives, namely, Percival Ross Frames and Allan Kincaid. The former of these is the managing director of the Premier Diamond Co., and the latter, who was manager successively of the Angelo Deep, Village Deep, and Bantjes, is now a farmer. The miners' representatives are H. P. Cresswell and Wilfred Wybergh. As the contract agreement under investigation does not seem to contain any very onerous regulations, the outcome of the deliberations is not likely to lead to any drastic amendments. No great amount of interest, therefore, centres round the forthcoming result. What really is of interest is the working of the Industrial Disputes Prevention Act. The miners have secured the services of two capable men who may be relied upon to present the case for them in the best possible way, and the mines have called in the good offices of two gentlemen who, not being concerned with the Rand or its labour disputes, are in a position to adopt a broad and conciliatory attitude. The Act will thus be given a fair and amicable trial, and, should the findings of the Board give reasonable satisfaction, there is little doubt that it will be requisitioned on many occasions in the future.

MELBOURNE.

The Mount Lyell Disaster.—The whole of Australia has been shocked by a disaster which can be easily accounted the biggest mining calamity that has befallen the industry during the history of Australian mining. At the North Lyell mine of the Mt. Lyell Mining & Railway Company, in Tasmania, the plug of an electric pump blew out, and the fusing of the wires set alight the timber at the 850-ft. level. About 100 men were working in this level, the 1000-ft. level, and at the 1100-ft. level. At first little notice was taken of the smoke, as it was thought that nothing unusual had happened underground. After a while, however, the smoke and the resinous fumes from the burning pine began to fill the workings. Then every effort was made to bring the men to the surface, but the cages jammed in the shaft and it soon became apparent that a dreadful disaster was imminent. The management kept the air-compressors going so as to give a supply of fresh air at the dead ends of the workings, where it was assumed that the men would congregate. Their efforts in this respect were partly successful. In the meantime, safety helmets were hurried across the Bass straits from Victoria and New South

Wales, and the firemen from those states volunteered to go below. A great deal of heroism was displayed by rescue parties, who braved the poisonous fumes in the endeavour to get at men who were imprisoned beyond the barrier of smoke.

The mine is worked from a main shaft, and there was also a winze from No. 3 level. Unfortunately the latter winze was partly thrown out of use quite recently, apparently owing to some crushing, and it was not for three days that communication at this part of the mine could be established with the lower workings. Then a cord was let down and it was found that a number of men were at the 1100-ft. level. At this time there were over 90 men underground.

of the official advice of the State Inspectors the step was taken. What has seized the community is the fact that in so big a property there should not have been a second means of escape available. It is quite true that there was the winze from the No. 3 adit to the bottom level as well as the shaft, but as the first-named working could not be utilized for some days, a decidedly bad impression has been created. This impression has been deepened by the statements of the leaders of Miners' Unions and of the Trades Hall Officials. These, in calling for a thorough investigation into the disaster, claim that the company did not have a man at the 850-ft. and 1000-ft. levels to look after the pumps. They say that if such had been the



ZINC CORPORATION'S PLANT.

The company was successful in getting up 50 of these men from the 1000-ft. and 1100-ft. levels, but nothing could be done at either the 700-ft. or 850-ft. levels. At one time it was thought that the fire was under control, but another outburst of smoke demonstrated that it was still raging. Then the question came as to what could be done. The Mining Inspectors of New South Wales and Tasmania and a party again sought to reach the men. They, however, were unable to penetrate far into the smoke-laden atmosphere, and it was at last decided, despite the fact that the bodies of over 40 men were below, to seal down the mine and flood it with water. When this decision was made, a week had elapsed after the fire was discovered, and it was felt that in the levels mentioned it was impossible that any human beings could survive.

The miners resisted this flooding, but in view

case, the outbreak of fire could have been suppressed in a moment. An unfortunate fact is that a little while since the miners alleged that the underground workings were in such a state that it was necessary that check inspectors should go below on their behalf to see whether the workings were safe. The management of the company at first objected to this being done, because they required compliance with certain conditions. Finally the matter was compromised, and the check inspectors went down with the mine officials, and then gave such a satisfactory report as to the condition of the mine that the workers, after going out on strike until the inspectors were permitted to go below, were allowed to resume their places in the mine. Still, the most is being made of the stand taken by the mine officials. The disaster is to form the subject of a most thorough investigation by a Royal Commission appointed by

the State of Tasmania. Everyone considers that this step should be taken, and it will go hard with the management if they are not able to establish that every reasonable precaution was taken by them to ensure the safety of the miners and to protect the property from such a disaster as has now occurred. Everyone who is acquainted with the directors of the Mt. Lyell company and its general manager, Robert Sticht, feels certain that no false spirit of economy would have prevented action in this direction. The public have responded to the appeal for assistance to the relatives of the men who lost their lives through the fire, and in addition substantial votes have been made not only by the Commonwealth Parliament, but by the State Parliaments, in the same direction. The effect of the fire upon the mines in all probability will be that work will cease for a considerable time owing to the flooding of the property. In the meantime the miners are being transferred to the Tharsis and Comstock sections of the property.

Iron and Steel.—The question of the supply of steel rails to the Commonwealth for the construction of the railway from Port Augusta to Kalgoorlie is so closely connected with the establishment of the iron industry in Australia that the public has been amazed to hear that the Commonwealth Government has had the screw placed on them by the tendering firms. In the first place tenders for the supply of a large parcel of steel rails were sent in by British, United States, and German manufacturers. King O'Malley, the Minister for Home Affairs, is a Yankee of the 'spread-eagle' type, who is always playing to the Labour gallery. He is by no means a fool, and has a reputation of being possessed of a considerable amount of this world's goods despite his socialistic proclivities. He thought, as a keen man of business, that the tenders submitted for the steel rails were too high and he endeavoured to beat down the tendering firms. The effect of this was apparently that they joined forces and elected to tender at a fixed price, subsequently to divide the work and the profits. The matter was brought to the notice of the public by a journalistic scoop on the part of one of the Melbourne dailies. The Broken Hill Proprietary company is now seeking to raise money to establish iron and steel works, and it can be said that the assertions made in regard to the pressure being applied by the steel trust combination are not at all in favour of that company. The Labour Party is sure to make the cry of the nationalization of the iron industry a big factor at the elections, in view of the

move on the part of the tendering firms, and is sure to receive a sympathetic hearing. In addition, the State of New South Wales quite recently, while agreeing to grant special terms to the Broken Hill Proprietary company, provided it established its works at Newcastle, announced that it intended to establish its own iron and steel works. The Government there is representative of the Labour Party, and its proposal in connection with nationalizing the iron industry would certainly be helped by the statements made in respect to the combination of steel-rail tenderers.

In this connection it is of interest to observe that a stiff debate is proceeding in the Victorian House of Parliament over brown coal, in connection with the electrification of the suburban railways. The question that arose was whether the State, in order to encourage the private enterprise in the direction of turning to account the brown coal deposits of this State, should give a contract to a powerful company to be formed in London and Germany for a certain portion of the machinery which would use brown coal from the Morwell deposits. On the face of it, with the splendid suburban railway service that Melbourne possesses and the need that exists for opening up outside territory in the State, it is a piece of extravagance for the country now to indulge in the electrification of the metropolitan railway system, but the Government apparently thinks it can save money by so doing. On the other hand, the corner of the Legislative Assembly thinks that as the railways are State utilities, the power of working them or any section of them should be in the hands of the State. In this they are joined by the Labour Party, which as mentioned in the preceding paragraph, is in favour of nationalizing the steel industry and, as a corollary, the brown coal industry. The view taken by the corner is that the State is quite able to carry out the work proposed to be undertaken by private enterprise, but it is doubtful whether the people who have this idea really know what the capitalists had in view. This was not only to generate cheap electricity for Melbourne, but to manufacture oils and sulphate of ammonia from the brown coal. The course of the discussion on this subject will be of tremendous interest and importance to the people of Victoria. Should it be found, whether by State or private enterprise, that cheap electric power can be generated from the brown coal deposits and that cheap manures and oils can be obtained, the immediate result will be an uplift in the industrial affairs of the State to a height which otherwise it never could hope to

attain. The great point about Sydney is that it is practically the centre of a magnificent coalfield. Cheap coal and cheap power means a lot to it, but if Melbourne is going to have these great advantages in addition, then its future with the fertile country it has at its back must be viewed from a fresh pinnacle.

Mining generally is quiet. The news concerning the Mount Elliott mine is not altogether re-assuring, but at the Hampden mine the preliminary difficulties have been overcome. At the Mount Cuthbert mine some excellent ore has been struck at two of the undeveloped leases of the property, so that this enterprise promises to have an important fu-

reserve, above the 1850 ft. level, as 250,000 tons of no specified value. This means that, during the last three years, the mill has been overtaking development at the rate of 60,000 tons per annum, and that the three bottom levels are much below the average. So much is this the case that, although a new Fraser & Chalmers winding engine, capable of hauling to 4000 ft., was installed in July 1909, no sinking has been done since, and the shaft is still suspended at 1900 ft. At 1850 ft. cross-cutting, driving, and diamond-drilling have failed to find any large mass of ore, and it looks as if the lenticular orebody, which ranges from 240 ft. wide to 300 ft. long, had petered out vertically



ture. At Broken Hill, in boring west, the South mine has struck an independent orebody 34 ft. wide averaging up to 24% lead; this development is of the utmost importance.

As regards gold mining the most interesting item is the favourable outlook for the development of a deep lead system at Ararat. It is on the Langi Logan gutter, which was once in the hands of Bewick, Moreing & Co., who unfortunately let it slip from their grasp.

KALGOORLIE.

The Kalgurli, during its financial year ended July 31, treated 121,800 tons for £251,630 and a profit of £105,632, against 125,655 tons for £298,546 and a profit of £150,063, for its previous financial year. Since the tonnage and value of ore reserve were last definitely stated on July 31, 1909, as 430,000 tons worth 57s. 2d. per ton, above the 1550 ft. level, 375,000 tons has been treated for a return of £880,000, or only 46s. 11d. per ton. Yet R. S. Black, the manager, now estimates the ore

as well as horizontally. The east side of the property, which consists of a continuation of the hill that has produced most of the gold from the Associated and Lake View Consols mines, is so covered with plant, buildings, and machinery that it cannot be exploited from the surface, but it may yet save the situation, if persistent prospecting in that direction is prosecuted from below.

Great Boulder.—Richard Hamilton, with his underground manager, J. Warwick, and Sydney Yeo, representing Lionel Robinson, Clark & Co., paid his fourth visit to the Great Victoria mine at Southern Cross since he took an option on it four months ago. Nine samplers have been at work for fully two months on the mine under the direction of Curall Hawkins of the Great Boulder, and, formerly, of the Ivanhoe Junction. They are rumoured to have broken down 40 tons of samples from the 300-ft. level, from the three cross-cuts of 100 ft. each at the 60-ft. level, and from the cross-cut of 125 ft. at the 300-ft. level. It is

said that the average of the samples is barely 20s. per ton, and that the show will be turned down. According to Mr. Yeo, no definite decision will be reached for the next two or three weeks, that is, until a complete assay-plan is prepared. The attempt to secure a permanent water-supply, by the aid of a Government subsidy of £1000, has proved a failure, and that is where the owners are feeling the pinch.

Cue.—On the advice of Harry P. Woodward, Messrs. Chesson & Heydon of Cue started an eastern cross-cut at the 500-ft. level of the Hidden Treasure mine under the 43 ft. bar that had completely cut off the lode. In a short time the lode was picked up 6 ft. wide, and worth quite 2 oz. per ton. The residents of Cue are jubilant over this discovery, as Cue, like most goldfield-towns, has been looking very sick of late. It is interesting to point out that, so long ago as 1894, Mr. Woodward stated that the Whim Well mine, which afterward lay dormant for 12 years till 1906, was a hill of copper and merely required quarrying, even if worked on a large scale. Recently Mr. Woodward, on examining the Coodardy tin-field, stated, if the assays were right, there were 250,000 tons of tin ore, which could be won by quarrying. Mr. Woodward also strongly urged the Government to test the deep ground of Fraser's mine, at Southern Cross, by a regular series of deep bores, but the Government did not accept his advice. Fraser's has an ore-shoot 1000 ft. long, which, above 300 ft., has produced £725,000 from 325,000 tons, and yet the mine, including the ancient 30-stamp mill and all equipment, such as a new boiler and air compressor, was knocked down to the West Australian Machinery Corporation for the miserable figure of £1500. The mine is now held for speculative purposes.

Coodardy.—W. A. Mercer, of London, has been negotiating for the purchase of several tin-mining leases at Coodardy, but wishes the prospectors to sink a trial shaft to 50 ft. to see if the ore persists. The lease, on which this work is to be done, is the Gladys, from which 25 tons were sent to the Cue No. 1 mill to be crushed. The mill had no tin-saving appliances, but samples of the pulp, taken from the end of the tables at regular intervals, assayed at the Great Fingall mine, gave the surprising result of 4% tin. Harry P. Woodward, the Government Geologist, before knowing this result, estimated that 250,000 tons of ore could be quarried; this, at the present price of tin, would mean £1,250,000. Bewick, Moreing & Co., general managers of the Great

Fingall, appear to be sceptical of the result of their assays, or, at least, of the genuineness of the samples submitted to them. Should the results be confirmed, the Coodardy field will be a big thing, as the Gladys lode is quite 15 ft. wide, and in the adjoining Atkinson claims the lode is 30 ft. wide.

The Fenian at Meekatharra is opening up well at the seventh level, and the mine is looking exceptionally healthy. During September the mill treated 2988 tons for a return of £9089 and a profit of £4689. This makes the total production of the mine, since 1904, £324,000 from 58,000 tons, and the total dividends £47,744. Two Wilfley tables and a Wheeler pan were added to the plant during October; this should add further to the output and profit. The good developments at depth make the Great Fingall's option on the adjoining Marmont of special interest, as both mines are operating on the same lode. A series of parallel veins has been proved to exist at Meekatharra, as at Boulder, and both the Fenian and Marmont may contain lodes still unknown. The Queen of the Hills, held by the Lake View & Oroya Exploration Co., for instance, is working a parallel lode on the west.

SAN FRANCISCO.

Oil.—Keen interest has been aroused in California by the negotiations for a change in control of the Union Oil Co. It has been variously announced that this concern had been sold to the Standard Oil Co., the Shell T. & T. Co., and the General Petroleum Co. Knowing that the Shell and Royal Dutch interests were expanding their holdings, it was at first accepted that the Union had passed to them. At the same time the Standard published an official denial of the report that it had purchased the company. It was finally announced on November 17 that the real purchaser was the General Petroleum Co., which is controlled by Eugene De Saba, John Barneson, W. P. Hammon, and their associates. By this purchase the General Petroleum Co. adds to its own holdings in the Santa Maria, Midway, Coalina, Fullerton, Sunset, Belridge, and Lost Hills districts, 152 producing oil-wells, 11 tank-steamers, 4 tank-barges, a tug, and 681½ miles of pipe-line, besides the outright ownership of 26,250 acres, of the mineral rights on 132,250 acres, oil leases controlling 56,189 acres, and 16,801 acres covered by mineral locations; also refineries and a well established selling agency. The Union Oil Co. is a Californian concern capitalized for \$50,000,000 and controlled by the Stewart

family, whose holdings are the ones transferred by this deal. It has been well managed and has been paying 6% dividends. The General Petroleum Co. is a newer concern with extensive land holdings but without as yet a large production. It is now engaged in building pipe-lines and is evidently to be an aggressive factor in the oil-market. A short time ago it purchased the Continental Petroleum Co., which owns 160 acres in the Midway field, 520 in Coalinga, and 5500 in the Mexican oilfields. The Continental was organized by William Graham of California and is the company in which A. Chester Beatty and H. C. Hoover are heavily interested. It is

close. The Southern Pacific has developed the Kern Trading & Oil Co., which operates on railroad lands and furnishes fuel oil for the road, while the Associated goes heavily into the general oil trade. Remembering the general disposition of the leading American financiers to stand together, it may be predicted that in any stiff battle between the English and Dutch interests on one hand and the Standard on the other, the Associated will be found with the latter.

Shortage of high-grade oil is felt not only on the coast but throughout the country. It is reported that the Standard Oil Co. is drawing on the surplus in the Illinois field at the



THE YAMPA COPPER SMELTER, IN UTAH, now idle

understood that they and their associates have gone into the General Petroleum Co. so that the latter secured by the deal not only land but backing. The money for purchase of the Stewart holdings in Union Oil Co. is said to have come mainly from New York. Since the Independent Producers' Association is in close friendly alliance with the Union, it is presumed that oil from this concern will also fall to the General Petroleum Co. Whether the Associated will go along with the crowd, thus isolating the Standard, is less certain. At one time it was announced that the Associated had been sold to the Shell interests, but that proved to be an error. Originally the Associated was a Southern Pacific concern but in recent years the relationship has been less

rate of a tank a day, which would exhaust the supply in less than a year. At the same time Illinois production is falling. It now seems that the shallow oilfields in the eastern part of that state are fairly well defined, while the newer fields in the central and western parts have not so far proved large. One feature that may prove of large significance is the recent discovery of oil in the Trenton formation far below the Carboniferous sand of the Casey field. At least three productive wells have been drilled and the possible Trenton field is large. As drilling will be 2000 ft. and over it would be easy to spend money unprofitably in prospecting. With admirable spirit the principal companies in the field, including the Standard, have joined in raising an explora-

tion fund of \$100,000. This is to be spent on wells placed so as to determine the geological structure in preparation for oil-well drilling, rather than in blind testing for oil. The site of the wells will be determined by a committee of which R. S. Blatchley, of the State Geological Survey, is to be one member. This is substantial recognition of the excellent work the official geologists have done in Illinois and a good example to operators elsewhere.

The shifting of smelting centres is an interesting example of the variations of an industry. The plant of the Tacoma Smelting Co., now a subsidiary of the American Smelters Securities Co., formerly smelted a good deal of lead ore, chiefly from the Coeur d'Alene (Idaho) and the Slocan (B.C.) district, though it also took ores from the west coast of Mexico and South America, and from the Orient. With the development of copper mines on the coast of British Columbia and in Alaska, its future is clearly indicated as a copper smelter, and the plant is now in process of re-building under the direction of W. H. Howard, superintendent of the Garfield plant of the same company. Meanwhile the Tooele (Utah) plant of the International Smelting & Refining Co., which was first built to smelt copper ores from the Bingham district, but which has never been able to secure enough copper ore from its affiliated mines to keep it in operation at more than part capacity, is developing into a lead smelter of considerable magnitude, three lead stacks having been built in rapid succession. Part of this ore formerly went to the Tacoma plant, but the favourable smelting terms accorded has served to bring out a considerable quantity of new ore, as is always the case. The copper smelter of the Granby company at Grand Forks (B.C.) is apparently nearing its end from the working out of the ore in the company's mines, as it does not treat custom ore, nor indeed has it at present any considerable visible supply of custom ore. The plant was built 12 years ago, and the estimated ore reserve will serve to keep it in operation for five or six years more. Meanwhile the company is building a smelting plant at its new mines at Hidden Creek, on the northwestern coast of British Columbia, so that as one plant ceases to produce dividends the other will come in as a producer. The Pacific coast is not an especially favourable situation for a copper smelter, since the amount of copper there produced is already much greater than the present or probable future market for that metal. Japan produces enough to supply its domestic needs and to furnish

some exports for the growing demands of China. Large deposits of copper ore are known to exist in the southwest of China, and if copper mining develops *pari passu* with the demand for copper in industrial development it is not likely that China will ever form a large market for foreign copper. Australia is also well supplied with copper. Some of the South American countries on the west coast of that continent are considerable producers of copper, part of the output now going to Europe and part to the east coast of America. The electrolytic refinery at the Braden mine will be able to supply South American needs of refined copper and the demands of the western part of the United States are now supplied by the Great Falls refinery, operated by the Anaconda Mining Co., and the sale of the product controlled by the United Metals Selling Co. The refined copper from the Tacoma plant is shipped to Detroit. Since the refined copper must go to the eastern United States in any case it is better to ship blister rather than refined copper, as the contained gold and silver is thus transported at a low freight-rate instead of a high express-charge, and the blister, being a less valuable commodity, secures a lower freight-rate than the more valuable refined copper. When the Panama Canal is opened the smelters of the Pacific seaboard will be able to ship to Europe direct.

MEXICO.

Depredations on Mines.—You will have heard how the followers of Zapata paid a visit to one of our mines at Zacualpam on August 26 last. Immediately on the occurrence of the incident, I communicated with the British Consul in Mexico, reporting that the Zapatistas had swooped down on the mine, forcibly seized the superintendent, and demanded \$5000 cash under a threat, in case of refusal to comply, of burning down the whole establishment. As the day on which this happened was that immediately following the regular pay-day, no such sum could be furnished, so the unwelcome visitors ransacked the buildings, carrying off all available cash and everything portable of value, and then put their threat into effect. In all, through the visit, we lost our assay-office, our mine-store, with all combustible supplies, and the ore-sorting house, the total value of which I assess at not less than \$5000. I do not know yet whether the damage can be charged to the Mexican Government, and, if so, by what means the value can be recovered.

Travel in disturbed area.—I got back here on Thursday last from Toluca, having been two days and a night on the road performing a journey which, under ordinary circumstances, I can negotiate in eight hours. At one time I found myself in the thick of a *combate* near Tescaltitlan, between about 60 Federal soldiers and an invisible enemy. The sensation was anything but pleasant. The whole affair arose through the report, since confirmed, that a group of about 40 bandits (mostly *pintas*, which indicated their Pacific Coast origin) had entered a small village just ahead of where I then stood and were robbing and plundering the inhabitants without the slightest resistance. As chance would have it, a company of soldiers was at that time on the march from Sultepec to San Juan de Las Huertas and had to pass within a few hundred yards of the spot where the bandits were known to be. Instead of investigating the circumstances and going to the help of the unfortunates, the soldiers simply charged their rifles and started blazing away into the air, at anything or at nothing in particular, and, without slackening one single step, they continued this performance until they were at least two kilometres beyond the danger zone. I lay concealed in a cornfield at the time within 50 yards of the road along which the firing was in progress and saw the whole affair, the bullets whistling over my head in a manner that made me uneasy. The bandits continued their robbery absolutely unconcerned and are now reported to be within two miles of where I am writing.

Robbery under arms.—Last night also an impudent letter was delivered at my house by a messenger from Fuentes, one of the revolutionary leaders in this district, in which he politely asks for the sum of \$5000 to be handed over to him within the next eight days. The letter is written in a business-like way and was delivered here with all the formality of a registered document, the bearer asking to have the envelope returned to him and signed by way of acknowledging its receipt, so that he could return to his chief with tangible proof that he himself had fulfilled his mission. I see no other course open but to compromise with the request, for if we refuse there is nothing more certain than that we shall lose everything combustible about our property and run the risk of losing our lives as well.

As regards our operations here, there is no use of the Mexican authorities claiming that foreign interests are being protected, and the

proof lies in the fact that the 50 soldiers sent here to Almoloya de Alquisiras after the British Consul's intercession on our behalf, have all been withdrawn, the reason assigned for this step being that it is unsafe to have so small a garrison remaining isolated, and that every soldier is now wanted for concentration and protection of the district headquarters at Sultepec. If it is unsafe for 50 soldiers to try to protect themselves, then what can be the situation for a few isolated foreigners who are



Main Street in El Oro.

without any protection whatever? I have personally interviewed the *jefe* at Sultepec and received from him the promise that the soldiers will be returned, but, so far, that promise has not been realized and we are entirely at the mercy of the first band of robbers that cares to visit us. And all this is within 80 miles in a straight line of the capital of the country.

General Conditions.—As regards this part of the country, affairs generally are in a most deplorable state and the bulk of the people are on the verge of starvation. Bands of robbers, which, a few weeks ago, were small, aggregating possibly ten or twenty badly

armed men, have now a roll of several hundred. The town of Tiscaltitlan, for instance, was attacked on October 24 by a band of over 400, half of whom were armed, the other half bringing up the rear with mules and burros to help in carrying the loot. The garrison of 35 soldiers instantly deserted and, before evening, everything of value had been seized. The storekeepers had to forcibly contribute \$2500 to save their homes from being burned to the ground. The following day another band arrived and took whatever the first crowd had left, and, the day after, still another, until at the time of my passing through there on the 30th, not even a cooking utensil nor a blanket nor even a particle of food was left, and at night the people were huddled together in the churches for safety and mutual warmth. Any one who makes a statement that Mexico is prosperous at the present moment has a most cordial invitation to pay me a prolonged visit. The climate is simply magnificent and there will be no lack of entertainment. The fact is that the Government forces are utterly inadequate to even police the country, and a very strong body of troops is now required to re-establish order, as there is no doubt that the bandits are the power in control. We certainly cannot continue operations much longer, paying taxes to the Government and toll to revolutionists, and having bandits all round us all the time. The pity is that if we shut-down there is no other work for our employees, and they must, by force of example, join some of the roving bands, which means more trouble for the Government. I am sorry that I cannot write with greater optimism, but of course there is no use deceiving one's self as to what is the real state of affairs.

CAMBORNE.

Goss Moor Tin Alluvies.—The report of this company's operations from August 15 1911, to August 31 1912, was recently issued. The former is the date upon which the erection of the new steam plant was completed and sluicing operations commenced. During the period referred to, the plant was actually in operation for 181 days; 44 days were occupied in shifting the barge to fresh sites as required, and 19 days in running down the concentrates in the boxes. In all, 193,620 cubic yards of gravel was handled, which is approximately 44 yards per hour. The return was 56 tons of black tin, or a little less than 11 oz. per yard, which realized £7561, or an average of £135 per ton, which is evidence of its high quality. The working expenses at the mine equalled

10'63 pence per cubic yard, the receipts from tin sales 9'37 pence, and the loss 1'26 pence. This loss at the mine (£1018) is attributed largely to the coal strike, for the plant was closed for 27 days owing to lack of coal; while the expenditure includes also the cost incurred in securing and testing some hundreds of acres of additional ground. The working cost is admittedly high; during the last few months it has been reduced slightly, and after certain unspecified alterations in working have been made, a further reduction is anticipated which will make gravel containing 0'65% black tin (the average of the period here reviewed) profitable. Experts who have visited the property have expressed the opinion that the bucket-dredging method of working would prove cheaper, and the question of forming a subsidiary company to work the ground north of the railway by this method is now under consideration. Negotiations are also in hand with an electric power company, which proposes to erect a station and sell the power at about a half-penny per unit. If such an arrangement is made, the company will be able to erect several small plants and so materially reduce the working cost. J. H. Collins is the chairman of the company, and C. G. Lush is the managing director.

Basset Mines.—It cannot be said, unfortunately, that these important mines are in a flourishing state, although during the past few months there has been a distinct improvement. During the period from January 1 to November 3 last, according to the official reports, 39,435 tons of ore has been treated, for a yield of 416 tons of black tin, equal to a recovery of only 23'6 lb. per ton, which compares with 30 lb. per ton for the year 1911. The value of 416 tons is estimated to be £54,289, or 27s. 6d. per ton handled, and the working expenses are put at £54,130, or 27s. 5d. per ton, so that the profit is trivial. If the estimate of the working cost is correct, there is a saving shown of 1s. 8d. per ton on the figure for 1911. The pumping cost at these mines is over 6s. per ton milled, owing to the very heavy quantity of water raised, and this, coupled with the exceptional (for Cornwall) rate of development, namely, one foot for every seven tons mined, accounts largely for the high working cost as compared with neighbouring mines. In Pascoe's shaft, the 320-fathom station has been completed and levels have been started east and west on the lode. These ends at the date of the last report were worth £50 per fathom, whatever that may mean. So soon as they are in a sufficient distance, the sinking of this main

shaft is to be re-commenced. A feature of the monthly reports issued by this company is the estimate given of the cost of the month's operations, and this might usefully be adopted by other Cornish companies.

Tresavean.—It has been decided here to concentrate on development by driving eastward at the 260 and 300-fm. levels in virgin ground and in sinking the shaft, and for this purpose further compressor plant is being provided. The erection of the battery has therefore been suspended until the results of these developments warrant its completion, which is obviously the right policy. The lode at the two points referred to is of fair width but variable in value. E. S. King is the general manager.

all its liabilities to that date, but also receiving in cash the value of the consumable stores. The purchase consideration is £38,400 in fully-paid shares, six of which will be allotted for each share in the present cost-book company. The cash underwriting commission is 4%, and a substantial bonus in the shape of one fully-paid share for every two shares subscribed for. The present management committee will constitute the new board, together with three nominees of those guaranteeing the capital. Bewick, Moreing & Co. will be the general managers, and Joseph Jennings will continue to act as superintendent of the mines.

The accounts for the three months ending September 30 last show a net profit of £1076, and a balance in hand of £3011. The black-



East Pool & Agar United.—These famous old mines are at last to be developed on a scale commensurate to their needs and possibilities. The scheme laid before the shareholders will provide £40,000 working capital if the present shareholders take up their proportion, but in any case £32,000 is sure, being underwritten by the directors and their friends, and by the London, Australian, and General Exploration Co., Limited. A new company is to be formed called East Pool & Agar, Limited, with a nominal capital of £100,000 in £1 shares. The new company will take over the mines as a going concern on January 1 next, the old company paying

tin sales for the period were 117 tons which fetched an average price of £128. 13s. per ton, or £15,078, while of the by-products, arsenic realized £1074, wolfram £916, and copper £103. In all, the receipts totalled £17,394, or 22s. 9d. per ton milled, and the expenditure £16,318, or 21s. 4d. The development footage for the quarter was 903, equal to one foot to every 17 tons of ore milled, while the average recovery was 18'58 lb. tin and wolfram per ton. The developments of late have shown a decided improvement, and their average content is well above the present grade of ore being milled. It is not anticipated that a dividend will be recommended at this stage, and

if this forecast is correct, there should not be far short of 15s. per share for division when the present company is liquidated.

Condurrow.—The water has now been drained well below the 290-fm. level, and the shaft cleared and put in order to that depth. It is hoped, when the 300-fm. level is reached and cleared, to drive west to get under the shoots that proved so productive in the previous working. The trouble here however is lack of working capital, but having overcome so many difficulties and reached the point where active development work can be undertaken with a fair probability of success, it would be a pity if the present shareholders do not provide the necessary further capital. If new people come in at this stage, those who have so far financed the undertaking are sure to be squeezed unmercifully.

Chamber of Mines.—There is a movement on foot to form a Chamber of Mines for Cornwall, and it is to be hoped that the promoters will succeed in getting the support of the mining companies and the leaders of the industry, for such an institution is one of the pressing needs of the mining industry at present. There never was a time when there was more cause for a general conference of the County's mining men on many topics which concern all.

Scarcity of Labour.—With so many new ventures starting, mines in the outlying districts are already feeling the pinch so far as miners are concerned, and it much looks as though the inadequate supply of capable miners will be one of the difficulties that will have to be faced in the near future. In conversation with a prominent manager the other day, he gave it as his opinion, speaking in a general sense, that all the miners who are left in Cornwall are old men and boys, and how to attract those Cornishmen who have migrated, and to keep the younger men when they have gained experience, is the problem. However, the folly of cutting the price when the men, by hard work, have earned a good pay, as was not unusual a few years ago, is now generally recognized. Payment by results, with a bonus when a specified tonnage is exceeded, would ensure to the miner an adequate return for his labour, and this system is gradually coming into operation. Day pay should be abolished as far as possible, for by experience it is found that men seldom put in more than six hours work on an eight-hour shift; they are often more interested in conserving their energies for work on their cabbage patch or garden when they get home.

TORONTO.

Porcupine.—Activity in this district has been paralysed by a general strike of miners, called on November 15 by the local branch of the Western Federation of Miners as the outcome of labour troubles that have been brewing for some time. A few weeks ago the managers of five mines in the Pearl Lake district, where higher wages had been paid than prevailed in other localities, issued a new wage-schedule fixing the rates at the figures obtaining at the Dome and Hollinger. The men appealed to the Canadian Department of Labour, which appointed a Board of Conciliation to make an investigation. A majority report was presented by the board, finding that, with one minor exception, the wages offered were fair and reasonable and advising the men to accept them. This they refused to do, submitting the question of calling a strike to a referendum of the miners, which resulted in their declaring for a general strike by a large majority. The number who went out was about 1000, the figures for the principal mines being approximately as follows: Dome, 300; Hollinger, 300; McEnaney, 80; McIntyre, 60; Dome Lake, 60; Porcupine Lake, 50; Hollinger Reserve, 50; Vipond, 50; Hughes, 40; Plenaurnum, 30; Jupiter, 25; Dome Extension, 25; Pearl Lake, 20; Three Nations, 20. Some of the less important mines, including the Pearl Lake, Schumacher, and Three Nations, have acceded to the strikers' terms and the men have gone back to work. The Dome brought in a number of strike-breakers and has been able to keep the mill running to capacity, having at last accounts about 150 men at work. The Hollinger mill is still in operation, and the company has a working force of 160, enough to get out ore to keep the stamps going. Practically all the other properties are closed-down. The struggle promises to be long and bitter. The Vipond mill closed down some time before the strike to enable some alterations to be made, rendered necessary by the installation of the cyanide plant. The funds for this purpose have been raised by a bond issue of \$125,000. The Hollinger, which paid its initial dividend of 3% early in the month and will make a similar payment every four weeks, accompanied the dividend-cheques with a comprehensive statement of the physical and financial condition of the property, including an interim report by the manager, P. A. Robbins. He stated that 20,444 tons of ore extracted in the course of development showed an average value of \$1970 per ton and 5777 tons from stopes yielded an average of \$37'89 per ton.

The average value of all the ore treated up to October 5 was \$23'69 per ton. The mill was treating 300 tons daily and making a 97% extraction from \$30 ore, but actual operations had shown a capacity of from 450 to 500 tons daily. President Timmins stated that the surplus on hand was over \$800,000, of which \$550,000 represented profits from operation. The profits were then at the rate of over \$40,000 per week, and the management were confident of continuing this rate undiminished. The appearance of these statements did much to strengthen the market. The results of recent diamond-drilling below the 300-ft. level, showing the existence of a rich orebody, has confirmed this favourable impression.

held at a low figure, has latterly been steadily advancing. The McKinley-Darragh has announced an extra dividend of 10% from January 1. The Nipissing's new low-grade mill has started operations with 10 of its 40 stamps, and the aerial tramway from the Meyer shaft to the mill is now working regularly. The Beaver is extracting ore from 8 levels and is working at a depth of 700 ft. Several veins that did not appear in the upper levels have been found in the diabase and are being worked, but the ore is widely disseminated and operations are likely to result in a heavy tonnage of low-grade, rather than in disclosing pockets of high-grade, ore. A new vein has been cut on the 460-ft. level, which shows 2 in. of high-



THE HOLLINGER MINE AND MILL.

Night Hawk Lake.—Active prospecting and exploration work is going forward in this district, and several good orebodies are reported to have been uncovered. The Canadian Mining & Exploration Co. is sampling a large low-grade proposition, the gold content of which is principally in the sulphides, with the object of taking it over and establishing a large plant should the showing be favourable. There is considerable confusion as to mining titles in this area, as some of the claims staked in the former rush, in 1907, that were supposed to have lapsed, are found to have been patented and are still valid.

Cobalt.—The most noteworthy feature of the month has been the appearance of the Seneca Superior on the shipping list with several cars of ore from the property held on lease from the Peterson Lake. The stock of the latter company, which has for long been

grade. The strike of the men employed at the Cobalt Townsite ended on November 5, the men returning to work on the old conditions. The La Rose is taking rich ore out of the 180-ft. level of the Lawson property, and is sinking to the 500-ft. level on the main holding to pick up the fault vein found at 380 ft. in the hope of finding it enriched at depth. The General Assets Mining Co. has taken over the Cochrane mine adjoining the Temiskaming, and will obtain compressed air to operate the drills from the latter. The same company will also operate the Red Rock with power obtained from the Green-Meehan power plant. They have also acquired the Ruby property. The Ontario government has removed the royalty of 25% on gross output payable by the Chambers-Ferland, until the company is able to pay a yearly 10% dividend, when it will be re-imposed. The Mill of the Casey Cobalt is treat-

ing 25 tons of ore daily with an average return of 40 oz. per ton. The Preston East Dome, which is operating the Silver Bar, has encountered a body of milling ore on the 50-ft. level. W. F. Campbell, of London, acting for British capitalists, has taken options on a number of claims in the Gillies Limit. Col. W. L. Malcolmson, of London, has also taken over five Gillies Limit claims on working options. The shaft at No. 4 workings on the Cobalt Lake, now down 185 ft., is to be sunk 100 ft. further. At the Lumsden a pocket of rich ore has been struck at the 223-ft. level.

Gowganda.—The successful operation of the Mann mine is creating renewed interest in this district. Twenty tons of 3000 oz. silver ore are now bagged for shipment over the winter roads, and 2000 tons of milling ore averaging 40 oz. silver per ton are on the dump. The company intends to build a concentrating plant and will sink a deep shaft. The Mann has acquired control of the adjoining Boyd-Gordon property and re-opened it with satisfactory results.

Official changes.—The Canadian Department of Mines, of which the Minister of the Interior has hitherto been the head, has been transferred to the Secretary of State's Department. As the result of recent cabinet changes the position of State Secretary has been assigned to Louis Coderre, M.P. for Hochelaga, Quebec, who consequently becomes chief of the Mines Department. Samuel Price, Mining Commissioner of Ontario, has resigned, and is succeeded by T. E. Godson, K.C., of Bracebridge.

NEW YORK.

Business conditions continue to improve and it is a matter of common remark that the presidential campaign did not at any time interfere with the upward trend. The old disposition to postpone buying "till after the election" did not show this year. Already it is difficult to secure delivery in many lines. In October the U.S. Steel Corporation was booking orders for May delivery, and such firms as the New York Engineering Co. have been figuring on importing pipe to fill orders. One of the largest builders of compressors and drills is entirely unable to fill orders and as far West as Denver factories in certain lines are working 65% overtime. After two lean years the country seems in for another rush and the cry of car shortage has already been raised. If a serious check to the rising wave of prosperity occur, the railroads rather than the politicians are likely to be blamed. Harassed

and amazed at the numerous and stringent regulations they were called upon to meet in 1910, and finding it impossible to float securities upon old terms, the railway managers cut off improvements and particularly repairs to equipment. It was in part a necessary, and was altogether a natural, act, but one result is that the roads are now inadequately prepared to handle the traffic offered. The companies have placed rush orders for equipment that have set the steel mills running to capacity, but three years work can not be done in one and some loss is inevitable. In October nearly 30,000 railroad cars and 240 locomotives were ordered with many contracts pending. It is now believed that by March there will be an actual shortage of pig iron, and coke supplies are already beginning to cause worry. In the first nine months of 1912 the total exports amounted to \$1,616,000,000, and imports to \$1,313,000,000. It is expected that the total foreign trade for the year will amount to \$4,000,000,000. Labour shortage is already beginning to be felt, especially in those industries in which Greeks and Slavs are largely employed. Men of these races have been going home to fight, by thousands, and in the Wisconsin zinc field alone, 12 mines were forced to close in October because the erstwhile miners were engaged in expelling the Turk from Europe.

The Geological Survey has been subject to frequent change lately. That of widest importance was the resignation of Waldemar Lindgren, who goes to the Massachusetts Institute of Technology to assume charge of the geological department. Mr. Lindgren is widely known for his scholarly investigations of ore deposits, and the Institute could not have chosen more wisely. For his place as chief geologist, the Director has chosen C. David White, whose work has been mainly in connection with studies of coal. Trained as a paleobotanist, Mr. White was later drawn into stratigraphical work in the coalfields, and still more recently has made interesting contributions to general problems connected with the origin and nature of coal. His promotion is generally considered as well deserved and as a recognition of the importance of the ultra-scientific man in the work of a great technical bureau. Another recent promotion was the naming of G. H. Ashley, also well known for his work on coal, as administrative geologist. He is expected to relieve the Director frequently of the burden of routine work. Two former members of the U.S. Geological Survey have recently become prominent in con-

nection with the development of Brazilian iron ore. C. R. Van Hise and C. K. Leith, whose studies in the Lake Superior region contributed much to the knowledge of iron ore and its genesis, are the moving spirits in an American syndicate that has acquired, by purchase, enormous holdings of high-grade iron ore in the district north of Rio Janiero. It is estimated that 100,000,000 tons of ore can be mined from lands belonging to this syndicate and much of it is extraordinarily high in grade: 69%, in fact. To develop the property a 400-mile railroad and a new harbour are needed. Despite the fact that investigations began only three years ago, offers to build the road and to operate a line of steamers to Europe have already been made, and contracts may be signed at any time. It is believed that transport charges can be brought within 6s. per ton and at this rate ore can be delivered to advantage in England, Germany, and the Eastern United States in competition with existing supplies.

ST. LOUIS.

Lead mining was the pioneer industry of Missouri and today this state produces nearly two-thirds of the crude lead ore and three-fourths of the crude lead-bearing zinc ore in the United States. More exactly the output of metallic lead in 1911, according to the excellent statistics collected by C. E. Siebeenthal of the U. S. Geological Survey, amounted to 182,207 tons of 2000 lb. each; equivalent to 44.86% of the total primary lead produced in the United States. St. Louis is again the great lead market of the country, and with the metal selling at 5 c. per lb. and above, this has been a prosperous year for lead miners. There are two main districts in Missouri from which lead comes: *a*, the Southwestern, where it is a by-product of zinc mining, and *b* the Southeast, where in the great disseminated deposits of St. Francois county in particular, there is an enormous reserve of easily won ore. In the last six years the United States production of lead has increased from 350,153 to 406,148 tons, and practically all the increase has come from the old lead mines of the Mississippi Valley among which those in the disseminated lead district are much the most important. There are here five principal companies: The Federal Lead Co., a Guggenheim concern; the St. Joseph Lead Co. and the Doe Run Lead Co., two sister concerns controlled by the Jones, Parsons, and Camp families; the St. Louis Smelting & Refining Co., controlled by the National Lead Co.; the Desloge Lead Co., controlled by the Desloge family. Each

of the first three named mine approximately a million tons of ore per year, while the last two together produce another million tons. Some notion of the scale of operations may be gained from the fact that the new Federal mill handles 4500 tons per day and the Doe Run No. 3, now crushing 65,000 tons per month, is being doubled in capacity. Ore containing an average of but 2% lead is being treated by one company, and it is to be remembered that lead is practically the only metal of value in the ore. While the concentrate contains an average of one ounce of silver per ton, the metal is only desilverized at one plant. At the Federal, H. A. Guess, the



The Missouri Zinc-Lead Region.

capable manager, saves a small amount of zincy iron-copper concentrate. This has been re-treated in a magnetic separation plant and small shipments of copper ore have been made for some time. Temporarily the zinc product has been stored but ultimately it too will be made to swell the profits. Late in October this separating plant was burned, but it is to be immediately re-built. The cost of mining and milling, because of the simple character of the ore, the large scale of operations, freedom from timber expense, and low cost of fuel, has been brought down to low figures.

Roughly the mining costs 80 c. per ton, and milling 20 to 30 c. With legitimate overhead and selling expenses, ore can be handled in this district at a total cost of \$1'25 per ton, and as a matter of fact all the companies are making excellent profits.

Dissatisfaction among minority stockholders in the St. Joseph and Doe Run companies, voiced in a circular issued by Robert Holmes of this city, just before the annual meetings in November, brought out some interesting facts about these companies. The St. Joseph was the first company in the district to work the disseminated ores, which lie below the old gash veins mined by the early French, Spanish, and American miners. Under the lead of J. Wyman Jones the diamond-drill was introduced in exploration and wholesale mining started. Success followed, and from the original concern has grown two powerful mining companies which incidentally own a railroad earning a quarter of a million dollars per year, with collateral smelting, farming, and merchandizing concerns. The stocks in these companies have paid excellent dividends and have been closely held. Control has always been in the hands of the families of the three men Jones, Camp, and Parsons, who started the venture. Their sons are now in charge, having 'inherited their jobs' along with their stock-holdings. Robert Holmes, who with his relatives owns a considerable minority interest, charges that the executive officers have been over paid and have contributed little to the success of the companies. According to his figures D. A. Jones, the president, received in 1910, \$66,000, in 1911, \$63,000, and in 1912, \$57,600, though spending but a few days on the property. Roscoe Parsons receives as director \$31,733 per year and in addition has a home built at an expense to the company of \$67,000. Other similar items are cited. No criticism of the technical work has been made though the policy of continuing to operate the old Doe Run mill, recently closed, was questioned. O. M. Bilharz, who has charge as engineer of the mines and mills of the two companies, is conceded to have done excellent work. Mr. Jones points out, in a circular to stockholders, that the figures quoted cover office expenses as well as salaries, and furthermore reviews the history of the companies. He shows that the Doe Run company since its organization in 1886 has increased its holdings from 100 to 7057 acres. In the past year 932,220 tons of ore has been hoisted, yielding 53,080 tons of concentrate and 33,729 of metallic lead, worth

\$2,267,155. All expenses, including operation and interest, amounted to \$1,687,167. The approximate net profit was \$576,988. A 3% dividend was paid in place of the usual 6%. It is estimated that next year, due to economies and enlargement of No. 3 mill, the net income will be doubled. Because of an active campaign of land-buying it became necessary a year ago to issue \$2,000,000 worth of bonds, but of these \$203,000 has already been retired. The showing of the St. Joseph company is equally good and while some economy in the New York offices may be desirable, no large change is anticipated.

Power in southeastern Missouri has been relatively cheap because of the proximity of the Illinois coalfields. Good steam coal has cost \$1'50 per ton, but even at this the large consumption has made economy desirable. The Doe Run company has a 6000-hp. gas-engine plant using Loomis-Pettibone producers and Snow engines. While there was considerable trouble in securing steady operation at first, matters seem to run smoothly enough now. The coal consumption is cut materially below half that necessary in a steam plant of the same capacity. In all some 16,000 hp. is used in the district with 10,000 more in neighbouring glass works. As the load factor is unusually favourable this possible market for a central station electric company is attracting attention and there are rumours of a power company to supply all the mines and works. Such a concern, if it be formed, may either build a steam-electric plant at the coal mines designed to burn the finer and less valuable sizes of coal, or may buy at wholesale hydro-electric power brought from Keokuk, Iowa. The great dam and power-plant at that point is about ready for operation and by spring it is expected that current will be delivered as far south as St. Louis at a price of \$28 per kw. per year. This, at least, is the reputed sale price to the local distributing company.

Zinc as well as lead is attracting attention in the Mississippi Valley to an unwonted extent. Spelter at 8 c. per lb. keeps all the plants busy, even though the Atlantic Coast cities are beginning to draw on Europe for supplies. Continued failure of natural gas in the Kansas fields is causing the closing of the smelters west of the Mississippi. Of 40 blocks of furnaces once operating in eastern Kansas only 7 are now running. In connection with the wholesale removal to Illinois, where coal is cheap, much expensive construction has been under way.

DISCUSSION

Our readers are invited to criticise anything appearing in this magazine and to discuss other subjects of general technical interest.

The Engineer in the Tropics.

The Editor:

Sir—I read the late Lane Carter's article on this subject with interest. As one who has had considerable experience in tropical malarial countries, a few hints may be of use to the younger members of our profession who are working or contemplate working in the tropics. I say, advisedly, the younger members of the profession, as the older man with previous tropical experience requires no advice I am capable of giving him. And in the tropics, as in England, what is one man's meat is another man's poison.

I would first, however, like to register a protest against any layman recommending to all and sundry what quantity or kind of drugs should be taken in the tropics. There is little or no excuse for this nowadays when there are so many doctors with tropical experience able to advise and to give each individual case attention.

As regards quinine, personally a daily dose of nine grains has not been recommended to me, and I have never known any tropical doctor recommend so large a dose for a regular daily one. And as to 10 grains of calomel as an average dose, well, it is prodigious. I should be sorry indeed for the man who started to dose himself with calomel in anything like such quantities. Calomel should, as a general rule, only be taken under doctor's orders.

To return, however, to our young engineer going to the tropics for the first time, I would strongly advise him before leaving England to go to a first-class tropical specialist such as doctors Manson, Simpson, or Kantly; be thoroughly examined, tell the doctor exactly what the future programme is, and having got the medical instructions, note and follow them.

If the engineer is to be placed on a working mine, he need not unduly trouble himself about medicines; he should simply report himself to the resident doctor on the mine and follow his advice. If, however, he is going into the bush, it is desirable to get the London doctor to advise what medicines to carry, and generally what to do in cases of ordinary malaria and blackwater. Carefully written notes should be made of the instructions, and if there is anything not at first understood, explanation should be sought.

The second question is outfit. This depends on whether the engineer is going to a

settled camp or going to travel. In any case, a camp-bed, mosquito-nets, and blankets should be taken. A sun-helmet must not be forgotten; a good supply of comfortable and strong boots, also plenty of underclothing and a few tropical suits. If travelling, a good assortment of food should be taken, packed in Venesta cases.

When in the Tropics a regular and rational life should be led. A man soon finds out what diet suits him; this is frequently a case of Hobson's choice. But he must not try to starve himself. If he is a teetotaler he should remain one as long as it suits. In any case nips must be avoided, and alcohol only taken after the sun is down. A good sun-helmet should be worn all day, even if it is cloudy; many men in West Africa would be alive to-day if they had not neglected this simple precaution. A touch of the sun in West Africa is more to be feared than fever, for its effects are more lasting.

Drinking water should be boiled and filtered.

Now for a few Don'ts:

- (1) Don't think you are going to die when you have fever: *you won't*.
- (2) Don't dose yourself if you can avoid it; the doctor will do that for you.
- (3) Don't allow yourself to get constipated.
- (4) Don't forget to take with you a warm suit and overcoat to use on your return journey landing in England.

On the return journey every care should be taken, for a man is not as fit as he feels. The doctor's advice about continuing to take quinine, etc., should be carefully followed.

On landing in England, report should be made at once to the tropical doctor seen before leaving, and his advice followed.

All this is elementary, but many of these precautions are neglected, and sickness is incurred that could have been avoided.

E. HOMERSHAM.

London, November 30.

Cemented Ore.

The Editor:

Sir—In your November issue, page 318, second column, paragraph commencing at line 22, you are in error in stating that at the Brown Hill (Hannan's Brown Hill Gold Mine) it was found necessary to remove the cemented ore by blasting. No doubt you will be able to revise your expressed view.

ERNEST WILLIAMS.

[Mr. Williams at that time was the representative of Bewick, Moreing & Co., the en-

gineers directing operations at the Brown Hill; therefore his evidence is conclusive. On further inquiry we learn that there was trouble such as we have indicated with a trial run on Lake View ore, but it was the Associated that had to face the difficulty in its more acute form. At that mine the contents of several tanks, not one only, were cemented so hard as to require blasting.—[EDITOR].

Definitions.

The Editor:

Sir—I want to join the “honoured correspondent,” whom you mention in your November issue and to object with him to your “highly dangerous” definition of ore as “metal-bearing rock that at a given time and place can be exploited profitably.” I am sorry to have to argue about the meaning of a word, but I disagree with you so absolutely that I feel it my duty to protest. I feel all the more like protesting because it is conceivable that some unfortunate mine-manager might be blinded by the light of your authority and run his mine in accordance with your definition, and thereby cause loss to his employers and cover himself with ignominy.

To put the matter concretely, I will take the case of a mine in the desert before the advent of the railway and of electric power. This mine contains a vein of quartz 30 to 50 feet wide, averaging £2. 10s. per ton, while the dacite wall-rock assays from a trace up to 6 pence per ton in gold and silver. In this quartz vein occur bunches of high-grade ore giving assays up to £500 per ton. The only method of turning this ore into money is by carrying it in wagons 50 miles to railhead, and shipping it thence by rail several hundred miles to a smelter. To pay expenses the ore must assay at least £6 per ton. The mine-manager knows that mills will be built after the coming of the railway and electric power, and that his costs will be reduced to £1. 10s. per ton, and that his 30 to 50 ft. of £2. 10s. quartz will pay him handsome profits. Consequently, he plans his mine-development work, as far as possible, with regard to the working of this £2. 10s. quartz. Now, according to your definition, the only ore in this mine is in the high-grade bunches, and the mine-manager should speak of his £2. 10s. quartz vein as ‘waste,’ and, therefore, if your definition was strictly followed our mine-manager in the desert would pay no more attention to the £2. 10s. quartz than to the barren dacite, and would call them both “waste.” I most strongly object to this nomenclature. I

do not believe that you can find an intelligent English-speaking mine-manager anywhere who would not call the £2. 10s. quartz of our desert-mine ‘ore.’ The mere fact that the quartz could not be profitably worked at the time of his speaking would not, and should not, influence his speech. He, very likely, would speak of low-grade ore, milling ore, second-class ore, but his mind could not be satisfied with lumping the dacite and the £2. 10s. quartz together under the name of “waste.”

I consider your definition of ore neither in harmony with common talk, nor with science, nor with mining methods. Your definition is not colloquial, for every mining foreman would call our £2. 10s. quartz “ore.” It is not scientific, for it is of the essence of science to distinguish and classify, and your definition confounds the barren dacite and the metaliferous quartz. And, certainly, your definition does not tend to good mining, for if mining methods were based on it our desert-mine-manager would throw his dacite wall-rock and his £2. 10s. quartz into one heap, instead of safely guarding his low-grade ore in the hope of lower future costs—a duty, I take it, incumbent on every honest mine-manager.

In view of the common-sense usage of the words ‘ore’ and ‘waste,’ I hope that you will see your way clear to revise your definition of ‘ore,’ and possibly you may accept the definition of the Century Dictionary: Ore. “A metalliferous mineral or rock, especially one which is of sufficient value to be mined.”

W. H. SHOCKLEY.

London, November 25.

[Our critic is almost as positive as we are, sometimes. Let us take the case of his supposed mine in the desert. There the operating cost is £6 per ton, therefore a large lode of quartz assaying £2. 10s. does not come under our definition of ore. Mr. Shockley protests that an injustice is done to the mine and to the manager. The latter *knows* that mills will be built and economic conditions improved, sooner or later, so that a handsome profit can be made out of the £2. 10s. stuff. Presumably there are gentlemen at Johannesburg who *know* that 17 dwt. stuff, figuring as “non-payable ore,” will yield dividends, someday, in the Greek kalends. To them quartzite assaying 17 dwt. is ‘ore.’ They may be wrong, and the mine-manager in the desert may be right. Thus the definition that omits reference to time and place is useless. We insert the reference to time and place so as to give precision to the definition. The Cen-

tury dictionary assumes it, for a "metalliferous mineral or rock" fails to define. There is gold in seawater and silver in the moonbeams. But the Century dictionary goes on to say: "especially one which is of sufficient value to be mined." Well, does not this involve the idea of time and place? Should rock containing 6 dwt. gold per ton have been regarded as 'ore' at Kalgoorlie in 1895 when the total cost of exploitation was 20 dwt. per ton? Would the mine manager in that particular desert have been justified in anticipating the railway, the water supply, the metallurgical inventions, the decrease in the price of labour, and a dozen other factors that tended to improve economic conditions? If not, then to what extent is anticipation justifiable? Of course, if the building of a railway or a mill is to make a big decrease in the cost, then an engineer or a manager may say that the mine contains, besides its reserve of assured ore, a quantity of material assaying £2. 10s. per ton, which on the reduction of cost to £1. 10s.—a reduction assured 12 months hence or 12 years hence—will become a highly profitable ore. Nevertheless, when the cost is £6 per ton the barren dacite wall-rock in the desert and the quartz assaying 50s. per ton are both 'waste.' A thousand tons of the one is as liquid an asset and as much a source of income as the other. The function of a definition is to define.—EDITOR].

Loose Nomenclature.

The Editor:

Sir—I have read with interest your timely editorial in the September number of the magazine anent the use of misleading terms in connection with mining.

Both in America and Australia mining is past the 'gold rush' stage. Exact methods and scientific management should aim to discourage the use of localisms and slang terms, when their chief virtue is originality, and their common characteristic, ambiguity.

A favourite term, popular in Australia, and misleading anywhere, is the word 'nozzle' in hydraulic mining, when it is intended to mean 'hydraulic giant.' The giant, no doubt, started by being a simple 'nozzle,' but today it is a machine of several component parts, least of which is the 'nozzle.' The dictionary meaning of 'nozzle' is "the extremity of anything." American manufacturers rightly apply the term to the detachable tip at the small end of the giant, but they also refer to 'nozzle butts'—'butt' being "the thick and heavy end." The Australian conception of 'nozzle butt,' to be

logical, would have to be the large end of the 'giant.'

The need for clarity in this particular case is apparent when we remember that some hydraulicking installations are figured from the 'nozzle butts.' A Hendy giant having an orifice at the 'nozzle butt' of 6 inches would, under, say, 400 ft. effective head, discharge theoretically 31'486 cubic feet per second, with nozzle removed. An orifice equivalent to the intake at the large end of this particular giant, say, 11 in. diam., would, under the same head, discharge nearly 3½ times this quantity of water.

In view of the existing practice of installing turbo-pumps for supplying hydraulic giants, expensive mistakes may be avoided by remembering the looseness with which, in the Colonies, the term 'nozzle' is applied.

ALEX. COLLEDGE.

Ipoh, Perak, October 16.

Processes and Publicity.

The Editor:

Sir—In the November issue of your magazine I note your editorial on 'Processes and Publicity,' which I read in the main with pleasure. You make one statement, however, which I think cannot be accepted, to the effect that I had attacked the Minerals Separation, Ltd., for their persistent silence. I desire to quote the exact words which I uttered at the meeting of the Institution of Mining and Metallurgy: "I do not know which to admire most, the excellent subject matter and presentation of Mr. Ashcroft's paper, or the fortuitous circumstances by which, for the first time for ten years, the black silence imposed from without upon the intellect and utterance of the Institution in regard to flotation processes is at last broken."

This is not an attack on anybody, but is simply an exclamation of admiration for a fortuitous streak of good luck.

THEODORE J. HOOVER.

London, November 16.

Mine Valuation and Mine Finance.

The Editor:

Sir—The discussion of this subject is distinctly advanced by Mr. H. C. Hoover's article in your October issue, for the reason that he offers a "practical proposal" in distinction to previous contributions, which he rightly says have been written almost wholly in the shape of destructive criticism. In my opinion, however, the value of Mr. Hoover's article would have been enhanced (and still may be so) if he

had cited the terms of an actual deal, or a fictitious case based upon one. Your readers would then have been able to judge whether the method adopted in the particular instance could be applied sufficiently generally as to make the proposal a practical one for the financing of an average productive and profitable mine. The issue of debentures against the security of the "profit assured," as proposed, is probably well suited to the finance of a mine with a huge ore reserve, able to withstand the many charges against it over a number of years. However, there are many companies, good enough to claim a right to live, that would shiver at the thought of the many obligations to be met from its brief interval of assured productivity.

In order "to adequately base" the profit assured, I presume it must be cut in half. Then follow the discount of the issue, flotation expenses, working capital, interest, amortization of the whole of the debentures, and the cost of concurrent development necessarily pushed along in feverish haste. It must also be remembered that debentures are fair-weather friends. Loss of expected profit, due to over-estimation, accidents, fire, and strikes, is an inevitable contingency.

Many a mine that would better have been left alone has been reconstructed by debenture holders trying to save themselves. Not only has their security gone, but they find themselves deep in a highly speculative morass. I think it is clear that the promoters and vendors would hold the majority of the ordinary shares, and therefore would control the administration of the mine by the voting power in general meetings, which could over-rule any representation the bondholders might have on the board. If debentures are to be introduced into mining finance in London, except as an expedient to raise further capital, it is because the spirit and pluck of the old-time speculator has fallen into the waste-paper basket amid the scrip of his many ventures. He is disheartened because he has so often put up the stakes and had no run. Yet the mines of the world owe their existence to him. If promoters and engineers would endeavour steadfastly to give him a better run for his money, they would not need to look beyond him for support. He is not afraid of a venture carefully planned, in which his chance of a fair share of the profit is "adequately based." He would much prefer the full legitimate mining risk, with the sport in it, than a deadly dull debenture carrying a false sense of safety.

On the other hand it is no use to go to a

pompous debenture man in a bank parlour or similar sanctum, and say there is no risk, when there is risk. He will study the speculative basis of the profit assured with a cold eye and will express its borrowing power in more or less vanishing terms. He will array all the factors enumerated in Mr. Hoover's article that must be assumed and estimated to ascertain the profit assured, and discount them one and all. He will ask for the balance-sheets of the past three years and expect that the profits shown as earned should cover the interest of the proposed issue at least twice over. As Mr. H. S. Denny says, in his letter on 'Phantom Profits' in the same number of your magazine: "Of course, these principles are only required in an industry and in a solid investment. They cannot be applied to a business that is intensely speculative." But if debentures are to be the basis of mine finance the security offered must stand the usual tests required of that class of share.

Mr. Hoover suggests that there would in time grow a sentiment favouring the creation of investment trusts in connection with mines, to hold primarily the less speculative portion of the securities as outlined in his article. Such trusts may solve the problem by appealing to a new type of investor, neither the true debenture holder, nor the speculative investor to whom I have referred, and if these trusts are successful in so doing, the mining engineers should have nothing but praise for a system that may revive the interest of a public that has for so long fought shy of mining enterprise.

ERNST LICHTENBERG.

London, December 2.

Cam & Motor Gold Mining Company.

The Editor :

Sir—In your November issue, under the head of 'Review of Mining,' mention is made of metallurgical difficulties in connection with the treatment plant now being erected at the above mines. As the statements are obviously based on incorrect information, we are sure you will be pleased to publish the real facts of the case.

The experimental plant, during a run of some six months, conclusively proved that the ore was thoroughly amenable to the class of treatment originally established by exhaustive laboratory tests. The one small departure from what was originally intended is the separation of the sand for percolation, thereby assisting the treatment of the natural slime and providing an easily handled fill for stopes. The plant as designed includes rockbreakers, dryers, ball-mills, roast-

ing in Edwards furnaces, mixing with cyanide solution; re-grinding of the oversize in tube-mills, classification of sand and slime, percolation of sand and vacuum-filtration of slime.

There has never been the slightest indication of the formation of plaster of paris (hydrated calcium sulphate) or of its cementing action, although as much as 150 tons of sand has been treated at one time, and the treatment of the natural slime by the vacuum-filter method has been found to give a high standard of efficiency.

Extraction during the experimental run was as high as 85% for considerable periods, and for 8 days averaged 87%.

PEARSE, KINGSTON & BROWNE.

London, December 2.

[Our information was given to us by an unprejudiced engineer recently from Rhodesia and apparently well informed. However, we take pleasure in giving Mr. Gerald Browne the opportunity to make this official statement.—Editor].

'Modern Mine Valuation.'

The Editor:

Sir—As the preface of my book on mine valuation was written later, and hurriedly, when I was abroad, I hope you will now find space for me to express my regrets at having failed to acknowledge your good offices; more especially with reference to the criticism of that portion which deals with mining finance. Perhaps you will allow me to further express my indebtedness to Dr. Willis, of the Royal School of Mines, to whom I am even more beholden than to yourself. I should also like to mention that the principle of the risk-rate was developed some years ago with Mr. John Fleming, when dealing with the most profitable plant with which to equip a Rand property of a certain life.

In your review, I notice that you touch on only the part of the book which sets out the financial aspects of the valuation problem. In reality, the remaining portion, dealing with serious and avoidable field errors, both in sampling and calculation, is of even greater importance to ordinary examination work.

M. H. BURNHAM.

London, November 29.

[Mr. Burnham's acknowledgments are welcome, but belated. People do not write books every day; when they do, they should acknowledge the source of their information and the assistance gladly given to them; and they should do so in the preface of the book, not in a letter of apology after the book has been published. The fact is that Mr. Burnham's writ-

ings were carefully and laboriously revised; he was given cordial help in the way of additional information, and his articles were published in *The Mining Magazine* and subsequently reprinted in pamphlet form for the author gratuitously. Then he published them in a book without a single word of acknowledgment.—EDITOR.]

A Christmas Suggestion.

The Editor:

Sir—It has often occurred to me that the mining profession, compared with others, is very behindhand in making provision for those of its members who find themselves in straightened circumstances.

There are surely many cases of men whose honourable careers are closing in poverty and ill-health through no fault of their own, but owing rather to the uncertainties and hardships of the profession they elected to adopt. Again, there must be instances of the widows of mining men struggling to educate their children or, perhaps, to keep themselves, and to whom a little timely assistance would be a godsend.

It would be a difficult matter to formulate a scheme to embrace the whole mining community, but much could be done by our various societies, acting separately or collectively, for the benefit of those of their members in need of relief.

I am writing this letter in the hope that you may decide to open up this question in *The Mining Magazine*, which, circulating as it does, in all parts of the world, will, I believe, bring not only strong support but many valuable suggestions.

Thanking you in anticipation,

H. G. PAYNE.

London, December 3.

[We refer to this letter in our editorial columns. The suggestion made by Mr. Payne is timely. Undoubtedly no man is more subject to "the slings and arrows of outrageous fortune" than the mining engineer, whose life is nomadic and occupation precarious. The profession may not be as rich as it ought to be, but, with its friends, it should be able to do something substantial for those that have had ill luck.—EDITOR.]

Mica.—Some excellent and unusual specimens of mica are on exhibition at present at the Geological Museum in Jermyn Street. This collection was made for the recent Optical Convention, and at the request of the Board of Education they have been lent for public exhibition at the museum.

COBALT

A summary of progress. Recent developments. British interests.

By CHARLES A. O'CONNELL.

THE production of silver from the Cobalt district, Ontario, Canada, has steadily increased from the commencement of operations in 1904, as will be seen from the following table:

Year	Fine Ounces	Value
1904.....	206,875	\$ 111,887
1905.....	2,451,356	1,360,503
1906.....	5,401,766	3,677,551
1907.....	10,023,311	6,155,391
1908.....	19,437,875	9,133,378
1909.....	25,897,825	12,461,576
1910.....	30,645,181	15,603,455
1911.....	31,507,791	15,949,019
1912 (estimated)...	30,000,000	17,381,558
	155,571,980	\$81,824,318

The silver production from the Wettlaufer mine, in the South Lorrain district, is included. The following table shows the dividends paid by the Cobalt mines to October 1, 1912.

Mine	%	Amount
Beaver.....	17½	350,000
Buffalo.....	163	1,603,000
Cobalt Central.....	4	188,460
City of Cobalt.....	23	139,312
Coniagas.....	95	3,800,000
Crown Reserve.....	260	4,578,901
Foster.....	5	45,700
Kerr Lake.....	144	4,320,000
La Rose.....	44½	3,141,685
McKinley-Darragh.....	126	2,830,558
Nipissing.....	151½	9,090,000
Right of Way.....	77	504,513
Silver Queen.....	21	315,000
Temiskaming.....	50	1,234,156
Trethewey.....	88	840,178
Temiskaming & Hudson Bay	—	1,660,854
Wettlaufer.....	40	600,000
		\$35,242,318

The above record shows a remarkable proportion of dividends to gross output. It does not include the distributions of profits made by the Drummond and O'Brien mines, which are close corporations, or that of the Cobalt Townsite mine, whose head office is in London. Both the Beaver and Temiskaming mines in the southeastern part of Coleman township have increased their production during the year. The Beaver company is now getting

good ore in the diabase beneath the Keewatin formation at a depth of 600 feet. The plant on this property, consisting of a Hardinge ball-mill and Hardinge pebble-mills, with the usual complement of sand and slime tables, has been doing excellent work. It has been announced recently that the capacity of this mill is to be doubled. The Temiskaming has had a most successful year; although the usual dividend of 12% has been paid, there remains a large cash surplus after paying for the North Dome property, at Porcupine, which was recently acquired by this company. The Lumsden, in the vicinity of the Beaver, is still undergoing exploration at the 400-ft. level. A number of veins and small lenses of high-grade ore have been found from time to time.

Near Kerr lake the Crown Reserve and Kerr Lake mines have both produced steadily. The Crown Reserve Co. has been able to maintain the dividend of 5% per month and add something to the cash reserve. This company has also been successful in the development of the McAneny property at Porcupine, a property that was acquired by the Crown Reserve about two years ago. The Kerr Lake Co. in its annual report issued recently states the ore reserve as containing over 6,000,000 ounces. A portion of this ore is under Kerr lake and it will be necessary to either pump the water from the lake or else drain it by driving a drainage tunnel from Cross lake. Either of these methods would be practicable, and it is probable that the work will be done next year. Both the Bailey and Penn Canadian companies are at work on Diabase mountain. Both properties have made shipments during the year and look forward to increased production during 1912. The following mines will show an increased production over former years: Beaver, Temiskaming, McKinley-Darragh, Cobalt Townsite, and Coniagas.

The Nipissing is still the premier mine of the district. The production for the year has been in excess of the dividend requirements, so that a substantial amount has been added to the cash reserve. The low-grade mill on this property will be in operation early in November and should add considerably to the production of this famous mine. The Buffalo

is erecting a combination amalgamation-cyanide mill, similar to that of the Nipissing, and expects to treat all its ore at this plant after December 1.

The Cobalt Townsite mine, which is situated in the south end of the town of Cobalt,

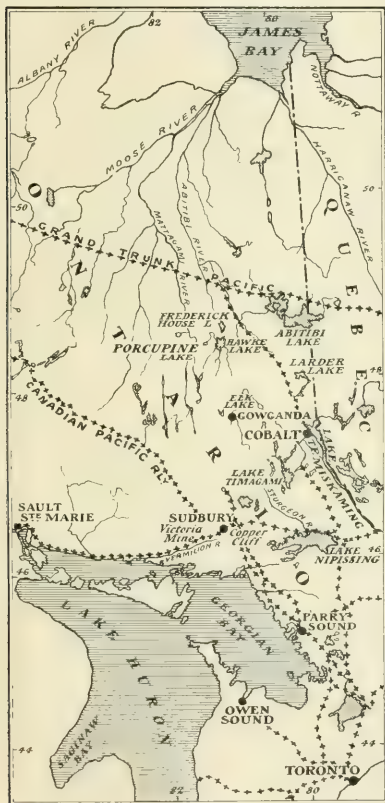
row strip on both sides of the right of way of the Temiskaming & Northern Ontario railway. It adjoins the Cobalt Townsite and City of Cobalt property on the west and the Cobalt Lake property on the east. The holdings of this company also include property in the township of Casey, adjoining the Casey-Cobalt mine. When the property was operated by the Stations Grounds Co., a shaft was sunk on the west side of the right of way to a depth of 200 ft. Some cross-cutting was done from this shaft, but the amount of work was limited. It is proposed to develop and explore the property through one of the shafts on the Townsite mine, and a cross-cut is now being driven north to enter the property at the south boundary.

In the Cobalt Lake mine a large vein was found recently in the fault-plane that runs through this property beneath Cobalt lake. The Drummond company has developed a body of milling ore in the southwest corner of their property, adjoining the Hargrave, and is shipping the ore to the Northern Customs concentrator, by means of the Kerr Lake branch of the T. & N. O. railway. The Foster property has been taken over under a lease by T. J. Flynn, late of Parral, Mexico. He has a crew at work, cross-cutting and driving in the undeveloped parts of the claim.

Some of the small mines have not produced as much ore as in former years, but, on the whole, the production for the 12 months will not be much under that of 1911. The operating conditions are satisfactory and there has been a good supply of labour this year.

In the outside districts, the Wettlaufer, at South Lorrain, and the Miller Lake-O'Brien, at Gowganda, have been producing steadily. The Millerette closed-down a short time ago, but it is announced that work will be resumed.

The surprise of the year was the finding of a high-grade vein at the Casey-Cobalt mine, situated in the township of Casey, 15 miles north of Cobalt. Operations have been carried on at this property for the past six years and the conditions were sufficiently promising to encourage further development. In the spring a body of milling ore was found, warranting the erection of a small concentrator, and shortly after this a vein 5 inches wide containing ore of a value of 5000 oz. silver per ton was intersected on the south end of the property. This vein runs into the Kismet claim, adjoining on the south, and this property has been acquired by the Casey-Cobalt interests. The mill at the Casey-Cobalt is now running and is treating 30 tons per day.



Northern Ontario.

is producing steadily at the rate of about 40,000 ounces of silver per week. During the year this company has done a large amount of work in the mine and a number of new veins have been found. The development of the property is carried on through three shafts and all of the milling ore is sent to the Northern Customs concentrator for treatment. The Townsite Extension mine, formerly known as the Cobalt Station Grounds, consists of a nar-

MINING POSSIBILITIES IN TURKESTAN

An Asiatic mining region. Favourable geological conditions. Coal, oil, and copper.

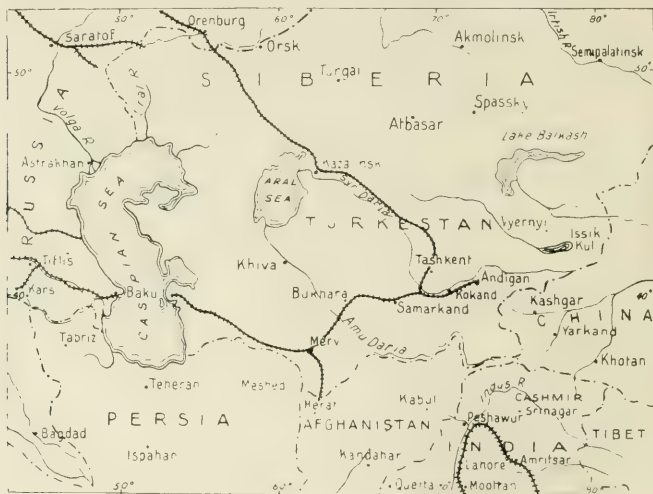
By ALGERNON NOBLE.

TURKESTAN is little known to mining men, therefore the following information gleaned during several months residence in the country may be of interest.

Before travelling or residing in the country all foreigners must get special permission from the Minister of War at St. Petersburg. I had to wait a month before my request to travel was granted.

rinski, Zakaspiski, and the khanate of Bukhara.

The main geological features of the country are embodied in a plan published by the Russian War Office from surveys made by G. D. Romanofski and E. V. Mushketoff from 1874 to 1880. The Tertiary, Jurassic, Triassic, Carboniferous, Devonian, and Silurian are all strongly represented, but much broken



MAP OF TURKESTAN.

The Government of Turkestan covers an area of 760,000 square miles and a population of 8,250,000. Compared with the Union of South Africa, it is therefore about 50% larger in area and contains 2,250,000 more inhabitants. The people of Turkestan are mostly Sards, who are tillers of the soil and small merchants. Next come the Khirgiz nomads and Tartars in small numbers. Russians are calculated to be about 10% of the total, but there are no statistics for this. The Government is divided into the provinces of Fergana, Samarkand, Semerechensk, Ser-Da-

up and metamorphosed by large mountain ranges, which run mainly in east and west courses with numerous short spurs running north and south. From the eastern shores of the Aral sea, between the rivers Ser-Daria and Amu-Daria, as far as the towns of Samarkand and Tashkent, the country is flat and of the desert type, nearly the whole consisting of Recent sand and clay. But east of these towns enormous mountain ranges extend both north and east of the Kokand-Andeghan railway line. North of the line the Ala-Tau rises to 10,000 ft., south of Kokand the



SELLING FODDER IN TURKESTAN.



A BAZAAR.

two big ranges, Turkestanski and Zarafshanski, rise to an elevation of 20,000 ft., while farther east and south of Andeghan another enormous range, the Alaishi, is in places over 20,000 ft. high. There are numerous smaller ranges and spurs. Above 10,000 ft. there is perpetual snow and glaciers exist. The mountain ranges are mainly composed of granite and gneiss rising through metamorphosed slate, sandstone, and limestone. Lying on the rims of these metamorphosed rocks, which are mostly Devonian and Silurian, are found the Devonian, Carboniferous, Jurassic, Triassic, and Tertiary formations.

Taking into consideration both the large area and favourable geological structure of the country, it is significant that hitherto metal mining has been mainly confined to claim-holding, with a few exceptions, and at the present time there is no large undertaking in full swing anywhere in the whole territory. The reasons for this are partly economic but mainly political. In the past Turkestan was in the path of those hordes that boiled over from China, Mongolia, and the Altai, fighting and slaughtering as was their wont in their western migrations. A continuous change of rulers and consequent shifting of population prevented any serious mining, the people living on their crops from year to year, ready to move to new districts at any time. The Russian occupation has tended to maintain order and is still on a military basis. The country during the last few years has shown signs of awakening and getting in touch with outside trade. The cotton business, fruit, and agricultural pursuits are increasing every year and better times are ahead.

The following figures of mineral worked for the last three years are given by the Mining Office.

Year	Coal. Poods.	Crude Oil. Poods.	Salt. Poods.	Copper Ore. Poods.
1911	6,000,000	2,000,000	800,000	none
1910	3,427,540	1,737,666	484,721	574,348
1909	2,715,785	847,742	756,710	67,446

The above figures are only worth recording for the purpose of bringing out strongly the fact that the province of Turkestan is quite undeveloped as far as its mineral resources are concerned. Coal is found in the Devonian, Carboniferous, and Triassic formations. The Devonian coal has not yet been exploited; the Carboniferous coal, where found outcropping, is on the eastern border and too distant to be of commercial use. Coal, however, is worked in the Triassic and Jurassic formations and obtains a high price. It is found

in the neighbourhood of Andeghan, south of Kokand, and south of Hodjent, where there exist small coal-basins of unknown shape. They are exploited by local owners practically without capital by entries from the outcrop. On account of transport charges, anything outside of 50 miles from the railway is left alone. In the Chimket district, coal, also of the lignite variety, has been found and will be tapped by the new railway that is projected between Aris Kool and Verney. It may be said, in passing, that the fuel question is becoming a pressing one in Turkestan. The small outcrop workings are quite unable to supply the demand and as a consequence the country is being scoured for a desert wood called *saxaul*, which has great heating properties. It is a slow grower and the supply will soon be depleted. Coal is retailed at from £2 to £3 per ton. The price and increasing demand is tempting enough to warrant serious consideration by capitalists.

Oil is being prospected in several places and the output will no doubt increase rapidly. Twenty versts south of the station Melnikok, the Santo company has struck oil. About 20 versts south of the station Vanofski, the firm of Nobel has taken over oil-lands and has been doing successful prospecting. English capital has taken over the Maileal oil claims that belonged to Prince Khilkoff, their situation being about 30 versts north of the town of Namangan. Possible oil-lands are said to exist all the way between the towns Andeghan and Bukhara and a good deal of claim-taking has been done by local people recently between these places. In the Zakaspiski province oil has been prospected for some time near the Caspian (east shore). The island of Chelekan is considered rich in oil, and other places where it has been found not far from Chelekan are called Kkorendzha, Miut, Kezel, Tepe, Bashekle, and Gubar. Owners will have to depend to a great extent on a local demand for their products, but this will undoubtedly increase in the natural course of events.

Most of the orebodies found in Turkestan have been mined for a few feet from the outcrop in past times, but in no place is there any evidence of work of any magnitude by the ancients. These old workings are supposed to have been done by Chinese over 1000 years ago, but I know of no definite proof of this assertion. The chief old workings exist on lead outcrops, of which there are many, and on copper. A small amount of gold has been washed, and is still washed spasmodically by natives on the river Heengau, about 200 miles

south from Kokand, but on account of the difficulty of access to this district very little is known about it. Siberian prospectors, who have within the last five years prospected most of the river systems, say that gold in small quantities is found in many places, but they have not been able to find anything worth working so far. A loose conglomerate, said to be Triassic, is found in patches along the banks of the rivers in Kokand and Andeghan, sometimes several hundred feet above water-level, and contains gold in small quantities.

An interesting occurrence of native copper

and ground to powder so that mining can be done with very little explosive. The hanging and foot-wall of red shale is tightly pressed into fault-crevices, giving evidence of enormous pressure. The greatest enrichment occurs where faulting has created a passage for solutions, and the sides of the fault-slips are always richer than other parts of the beds. Rounded nuggets of copper, not solid but intermixed right through with sandstone grains, are found in patches of quite otherwise barren sandstone and away from faulted ground. The main enrichment consists of small grains of



Claim marks on cinnabar lode.



Native Miners.

in sandstone is being opened up about 15 miles west from the town of Kokand, at Naukat. Here a series of sandstone beds have been tilted nearly vertical (to 80° from the horizontal) and contain native copper, said to average 1%; and though nodules and richer patches occur, it is also the fact that the beds where explored have given less than 1% in places. The enrichment can be traced for a distance of 12 miles, and 10 separate sandstone layers have been observed with copper. Barren red clays and sandstones are found between the copper beds. The greatest depth attained at present is 280 feet. In the tilting process the sandstones have been much compressed

native copper near the faulting. A concentrator with trommels, classifiers, jigs, and Wilfley tables has been erected, capable of treating about 600 tons per day. The ore is so easily disintegrated that it is merely dumped on to a 3-inch bar-screen and from there drops into trommels, where it is broken up sufficiently to be sent to classifiers. This business is at present held up for want of capital. It is interesting to note, by the way, the number of copper enrichments in this part of the world that have been found in sandstone. North of Turkestan, in the Orenburg district, are carbonates in sandstone going about 2½% and under, classified as Permian. Then far-

ther south on the Akmolinsk steppes is the Atbasar company's high-grade enrichment of bornite and glance, and south of this again here in Turkestan are the Naukat deposits. The writer has also seen sandstone with copper enrichment in two other places in Turkestan, but not yet sufficiently developed to be classed as commercial propositions. Copper is found outcropping as carbonate in all the mountainous districts of Turkestan, mostly in highly acid rocks. Out of samples brought to me from 18 different places, two were in limestone, two in porphyry, and the rest in quartzite. All these outcrops are quite undeveloped and await the prospector. The lead outcrops are mostly found in the foot-hills in the Chinkent, Kokand, and Andeghan districts. All that I have seen are in limestone, and quite undeveloped. Claims have been located over most of the best-looking outcrops both of copper and lead; the owners of these claims however do no serious development at all and endeavour to sell their rights. Some good-looking cinnabar outcrops in limestone and shale have been recently found 60 miles south of Andeghan and will be prospected this summer.

Climatic conditions are excellent for Europeans; in fact, it would be difficult to find a better. Fruits of all kinds, except the highly tropical, are grown in the valleys, together with tobacco and cotton. Fresh fruit and vegetables can be bought all the year round. The average winter temperature in the valleys is 50°, and in summer about 90 degrees.

The Indian Minerals.—The Director of the Geological Survey in his report for 1911 gives the following figures for the value of the output of minerals in India during that and the previous year:

	1910	1911
	£	£
Coal	2,455,544	2,502,616
Gold	2,202,486	2,238,143
Petroleum	835,927	884,398
Manganese ore.....	849,455	698,701
Salt	565,078	469,235
Saltpetre	233,765	220,012
Mica	177,152	188,642
Lead ore and lead	163,022	181,989
Tungsten ore	38,873	99,989
Ruby, sapphire, and spinel	58,849	67,594
Iron ore	9,811	44,487
Jadestone.....	64,747	41,660
Tin ore and tin	18,578	24,931
Totals	7,698,000	7,657,000

The diminution is due to the smaller production of manganese ore.

A NEW COPPER DISTRICT

By J. W. BRYANT.

CONSIDERABLE interest is being taken in the copper districts about to be opened up by the proposed railway from Haines, on Lynn canal, Alaska, into the interior of the Yukon and Alaska. This route was long used by the natives in their inter-tribal intercourse, and first came into prominence among white people during the Klondyke excitement. The first section for 40 miles from the tide-water terminal on Lynn canal is in Alaska, after which it passes through British Columbia for 40 miles, tapping the Rainy Hollow mineral district; it then enters the Yukon territory, traversing it for 235 miles to the international boundary. This section opens up the Kluanne and White River copper districts. The outline map on the opposite page shows the position of Rainy Hollow, and of that part of the world between Treadwell and Juneau to the south and Dawson City and the Yukon River to the north. As is well known, the Alaska coast is mostly glacier-bound and the high range of hills forms an almost impassable barrier. The new route follows one of the few possible lines of entry to an attractive hinterland.

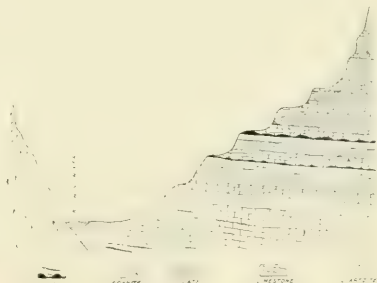
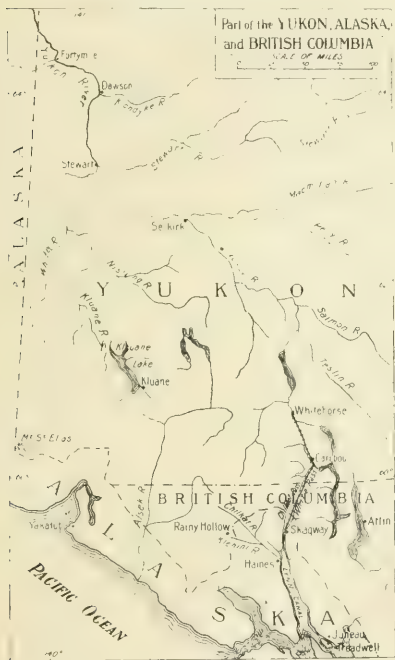
The Rainy Hollow district, being the nearest to the coast, has naturally been the first to claim the attention of capitalists. Several prominent mining corporations have been investigating the district during the last two seasons. This mineral area is situated at an elevation of 2000 ft. above sea-level in the basin known as Rainy Hollow at the headwaters of the Klehini, a tributary of the Chilcat river. It is in British Columbia, about 10 miles from the boundary line dividing that Canadian province from Alaska, and 50 miles from the port of Haines. Haines is in the same latitude as the north of Scotland, and is about 1000 miles by water on an inland channel from the ports of Vancouver and Seattle, and only 100 miles north of the famous Treadwell mines.

The United States Government has built a wagon-road from Haines to the boundary between Alaska and British Columbia, at a point that is nearest to Rainy Hollow, costing over £20,000, while the B.C. Government has bridged the Klehini river and completed the continuation of the American line to Rainy Hollow. These roads follow the valleys of the Chilcat and Klehini rivers on an easy grade. The valleys are well timbered with

spruce, hemlock, and some particularly fine cottonwood trees.

The Klehini river at Rainy Hollow is practically the dividing line between the granites on the south and the sedimentary rocks on the north; the mineral belt, being on the north side of the river, is therefore in the sedimentary formation. This is composed of almost horizontal beds of limestone, slate, and a hard silicious rock that was no doubt originally a

posed of limestone and garnetite. Outcrops of galena and blende associated with limestone and garnetite can be seen, and although sufficient work has not been done to prove their extent, they are well worthy of further development. Pyrrhotite in a massive form containing small quantities of chalcopryrite occurs alongside of silicious dikes that cut through the sedimentary formation and can be traced for long distances on the surface. In another series of veins, known as the Custer, the ore also accompanies the intrusive dikes, with the difference that at the highest elevation these veins contain galena and zinc-blende; these same veins at lower elevations, however, contain practically no galena, but more blende with the addition of pyrrhotite. The dikes are parallel and appear to be closely connected with the granite: they have a northerly strike, and a dip of 60° west. At the north-eastern end of the mineral belt large deposits of magnetite containing chalcopryrite occur in the limestone near its contact with the granite.



Geological section across Klehini Valley.

sandstone but which has been cemented to a homogeneous material by secondary silica. Owing to the slates and silicious beds being less susceptible to erosion than the limestone, they can easily be detected from a distance by the peculiar topography of the country, as they form the steep hillsides, whereas the flat slopes are composed of limestone.

The limestone is highly crystallized, and where ore-bearing it is altered to garnetite and minerals typical of contact metamorphic deposits. Bornite carrying silver and gold occurs in the form of flat deposits conformable to the surrounding strata in a gangue com-

The development work was practically all done before road or bridges were built, and it was carried out under great difficulties. Several hundred feet of adits has been accomplished and a considerable number of shallow pits have been sunk.

Two trial shipments of ore were made to the Puget Sound smelters, with the following returns:

From the Maid of Erin claim: 30 tons; copper 32.17%, silver 55.67 oz. per ton.

From the Copper Butte claims: 25 tons; copper 25.36%, silver 42.73 oz. per ton.

The Klauane and White River districts are entirely undeveloped, and little has been done in the Rainy Hollow district, but from what is known the outlook is encouraging.

REINFORCED CONCRETE FOR ROOFING A LEVEL

By W. FISCHER WILKINSON.

DURING 1912 some experimental work with reinforced concrete was carried out by me at the King Edward mine, belonging to the School of Mines of Cornwall, with the object of giving the students experience in the use of a material which is everywhere finding more extensive employment underground. Two places in the mine were selected for experiments in roofing levels with reinforced concrete in place of timber. One place, at the 10-fathom level, was a small gallery, about 7 ft. by 3 ft. 6 in., covered by timbers in the last stage of decay, supporting the waste-filling of an old stope. The other place, at the 30-fathom level, was a larger gallery with a span of about 8 ft., roofed with timbers that were sound. Above this level the lode had been stoped some feet upward, allowing the concrete roofing to be built immediately above the timbering. The method proposed for working the stope was back-stopping and filling with waste brought through a pass from the level above.

In both cases the roof-timbers were left in place. In the smaller level the timber was of no further use, and as it was possible to roof the level over with reinforced concrete underneath the old timbers, there was no object in taking them down.

In the case of the larger level the concrete roof was built over the old timbers, which were left in place as a precaution in case the new roofing proved unsuccessful. It was, however, the intention to take down later the old timbering for use elsewhere. The walls in both cases consisted of decomposed granite enclosing the lode. There was no support for the side-walls in the case of the larger level, but in the smaller level the foot-wall was lagged, as the granite here was specially soft and had a tendency to flake.

The principal difficulty in the smaller level was to support the cap and the waste-filling above while the walls were being built. The level was timbered with a half-set, that is, one leg or post on the foot-wall side only, the cap resting on this leg and on a hitch cut in the rock on the hanging-wall side. The leg had to be removed so that an 8-in. wall of concrete on both sides of the level might be built. This was done by supporting the cap by a false lag-placed 10 inches from the wall, which served

to support 2-in. plank forms for the concrete wall. The accompanying drawing showing plan and section explains the work done. After the side-walls had reached the height of 6 ft. 6 in., a plank roof supported by light sets was built, in short sections, commencing from the end farthest from the cross-cut. Short pieces of old 16-lb. rail were then laid across the level at an inch above the top of the wall at 3 ft. 6 in. centres. A covering of about 2 inches of fine concrete was then laid on the boards, and on the top of this were placed sheets of expanded metal, each 4 ft. long and 3 ft. wide, securely fastened to the rails by stout wire. There was an overlap of 3 inches at each rail. About 4 inches of concrete was then rammed-in from the advancing end. Owing to the presence of the old timbers it was only possible to work in short lengths of four feet at a time, and the sheets, which were supplied in 8-ft. lengths, were cut in half. The rails were not really necessary, and it would have been better to place the sheets with the long way of the mesh at right angles to the level, on the top of the walls, the span of which was only 30 in. as against a selected span of 3 ft. 6 in. between rails. The expanded metal would have then been lower down in the concrete and of course far more effective for resisting the tensile stresses. At the place where a cross-cut joins the level a larger piece of roofing was required; this was done, as will be seen from the plan, by covering the entrance to the cross-cut with old rails placed close together and covered with concrete, but not with expanded metal. The metal sheets were supplied by the Expanded Metal Company and were known as No. 9, 3-inch diamond mesh, the properties of which were as follows:

Size of mesh S.W.M. (short way of mesh) 3 in.

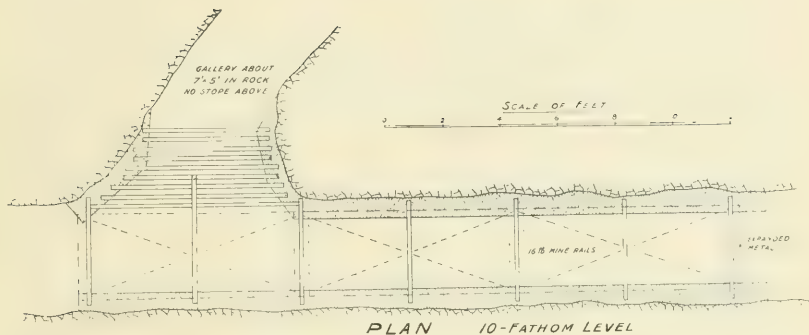
Dimensions of strands $\frac{3}{16}$ by $\frac{1}{8}$ in. bare.

Approximate weight per yard super $5\frac{1}{2}$ lb.

Calculated sectional area of strands in one foot run S.W.M. 0.1875 in.

Tensional value in one foot run S.W.M. at 16,000 lb. per sq. in. 3000 lb.

As the rails were placed an inch above the top of the side-walls there was an inch of concrete below the rail. When the boarding was removed, it was found that the concrete failed in places to hold to the rail and these exposed



spots had to be specially plastered afterward.

The concrete was mixed in the mine in the proportion of 1:2:4. The stone consisted of hard lode-stuff from a neighbouring dump mixed with granite and was broken to about $1\frac{1}{2}$ in. cubes. The sand consisted of tailing from the mill. The cost of the stone and sand was merely the cost of transport. Cement cost 36s. per ton, and the expanded metal 1s. 2d. per square yard.

The following is a comparison of cost of concreting and of timbering on the 10-fm. level:

Cost of Concreting.

	£.	s.	d.
Rock 187 cu. ft., say 10 tons at 1s.....	0	10	0
Sand 109 7 .. 6d.....	0	3	6
Cement 57 1'75 .. 30s.....	3	2	2
Expanded metal, 4 sheets, 3 by 8 ft.			
No. 9, 3 in. diamond mesh, 1s. 2d. per sq. yd.	0	12	4
Rails, say 300 lb. at 50s. per ton.....	0	6	0
Timber forms, depreciation of.....	1	0	0
Labour (estimated)—			
2 men for 18 days at 4s. 2d.....	7	10	0

£13 4 0

Total cost on 24 ft. run: 11s. per foot.

Estimate of Cost of Timbering.

One post and one cap, and lagging on top and one side only, 6 sets at 4 ft. centres.

	s.	d.
Cap and post (6 by 6 in.) 14 ft. at 6d. per ft.....	7	0
Lagging 24 planks, 4 ft. long at 2d. per ft.....	16	0

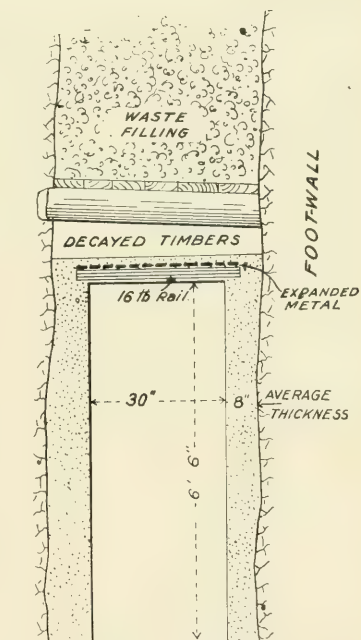
23 0

	£.	s.	d.
Timber, 6 sets at 23s.....	6	18	0
Labour: 2 men for 18 days at 4s. 2d.....	7	10	0

Cost of 24 feet.....14 8 0

Cost per running foot: 12s.

If timbered with a full set and with lagging on top and on both sides the cost would have



END VIEW.

10-FATHOM LEVEL

been 15s. per foot. Concreting, therefore, was cheaper than timbering and a much stronger job.

In the larger level the work was easier, as there was an open stope above the stulls, upon which the miners worked. The first operation was to cut hitches for the old rails spaced at 5-ft. centres. These were then boxed-in to form a beam 7 by 6 in.; at the same time a plank flooring for the concrete was laid a few inches above the old lagging, this flooring being covered with oiled paper to facilitate the removal of the forms when the concrete had set. The boxes forming the beams were then filled with concrete, which was also spread for about one inch thick over the whole floor. On the top of this concrete were placed the sheets of expanded metal, 8 ft. long, overlapping 6 inches at the rails, to which they were secured fastened by stout wire. On the top of the metal sheets a 5 in. bed of concrete was placed, being well rammed, especially at the sides.

The expanded-metal sheets were, of course, trimmed by shears to suit the walls, which averaged 8 ft. apart. There was a rise in the middle of the stope and the method of securing the walls can be easily seen from the drawing. The forms for the concrete walls were kept in place by dividers spaced five or six feet apart. The concrete mixture was the same as that used in the smaller gallery.

According to the following estimate, the concreting cost 6'57s. per running foot, as against 8s. for timbering.

Cost of Concreting.

Roofing 26 ft. long by 8 ft. wide.....	4'86 cu. yd.		
Walling	5'47 "		
	10'33 "		
	£.	s.	d.
4 sheets, 39 sq. yd., at 1s. 2d.....		2	6 0
Rock, 319 cu. ft., 1s. per ton.....		0	16 0
Sand, 217 cu. ft., 6d. per ton.....		0	7 0
Cement, 81 cu. ft., 2'45 tons at 36s.....		4	8 0
Rails, 0'4 ton at 50s.....		1	0 0
Timber, depreciation of.....		0	11 0
Labour (estimated) 42 shifts at 4s. 2d.....		8	15 0
		£18	3 0
	£.	s.	d.
Cost of roofing.....	8	10	6
.. walling	9	12	6
	£18	3	0

Estimated Cost of Timbering.

Timbering with stulls and lagging, 4 ft. centres.

	s.	d.
One 9 in. diam. stull, 8 ft. at 7d.....	4	8
Lagging: 14 planks, 4½ ft. at 2d. per foot.....	10	6
Labour: 4 shifts at 4s. 2d.....	16	8

31 10

Cost per foot 8 shillings, as against 6'57s. for concreting.

As regards the labour cost, an estimate has been made, as no exact figures could be kept. The miners were quite new to the work and a good deal of time was spent in experimenting and in explaining to the students, who assisted, what was being done. Owing to the irregularity in the width of the stope, much time was also spent in cutting and placing the boarding for the concrete. The time put down in the estimate is what I consider fair for men accustomed to the work.

With regard to the strength of the concrete roofing at the 30-fathom level, the Expanded Metal Company, who kindly made some calculations, reported as follows:

It has been found that the beams reinforced with 16-lb. rails have a strength much in excess of the slabs reinforced with expanded metal. The strength of the slabs, therefore, regulates the load-carrying capacity of the platform as a whole.

Slab, 6 in. thick; span 5 ft. centres of beam; reinforcements No. 9 E.S. 5 in. below the top surface.

Area of No. 9 E.S. per foot of width = 0'1875 sq. in.

Percentage of reinforcement

$$= \frac{100 \times 0'1875}{12 \times 5} = 0'312\%.$$

Allowing a safe stress on the E.S. of 17,000 lb. per square inch, it can be shown that the stress in the concrete will not exceed 400 lb. per square inch.

The moment of resistance M R is therefore $K b d^2 = 48$ by 12 by 5 by 5 = 14,400 lb.

Taking a bending moment = $\frac{W L}{10} = M R$

$$W = \frac{14,400 \times 10}{60} = 2400 \text{ lb.}$$

This is the load on a strip of slab 12 in. wide.

The safe load per square foot will therefore be

$$\frac{2400}{5} = 480 \text{ lb.}$$

The breaking load will therefore be about $480 \times 4 = 1920$ lb. per square foot.

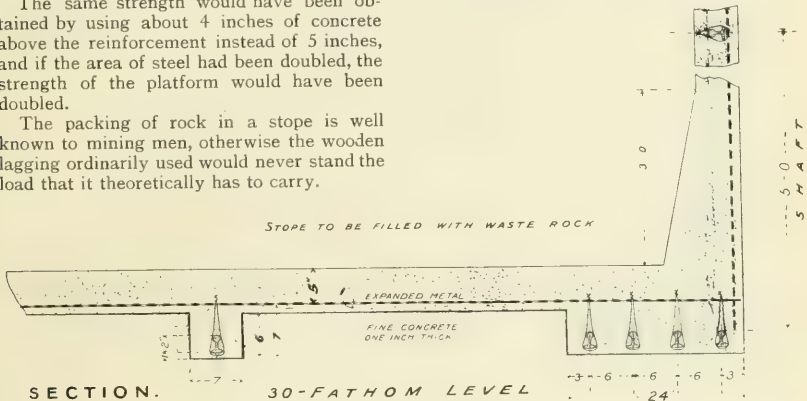
Taking the loose filling carried by the platform as weighing 100 lb. per cubic foot, the slab would fail when the filling is 19'2 feet deep provided it were free to move. As, however, the filling arches over and thrusts against the side walls of the cutting, thus relieving the platform of a considerable portion of the weight, it is probable that the slab would never be broken by the filling however deep unless of course it was waterlogged.

From the above calculations it appears that the proportions of steel to concrete were not well chosen.

The same strength would have been obtained by using about 4 inches of concrete above the reinforcement instead of 5 inches, and if the area of steel had been doubled, the strength of the platform would have been doubled.

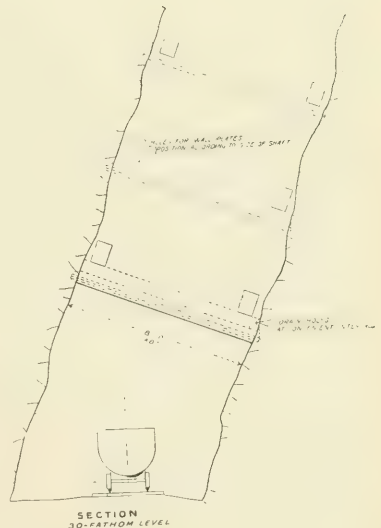
The packing of rock in a stope is well known to mining men, otherwise the wooden lagging ordinarily used would never stand the load that it theoretically has to carry.

13. Concrete in Mining. George S. Rice. *Mining and Scientific Press*, May 27, 1911.
14. Designing and Sinking of Shafts. R. G.



I append the following list of papers and articles on the use of concrete in mines:

1. At the Bethune Colliery, Pas de Calais. Report of Royal Commission on Mines, 1909.
2. *Mines and Methods*. June 1912.
3. Mine Timbering in Steel. R. B. Woodworth. Paper read before West Virginia Coal Mining Institute, December 7, 1909.
4. Underground Steel Constructions. R. B. Woodworth. Paper read before Lake Superior Mining Institute, August 1910.
5. The Brier Hill Concrete-lined Shaft. William Kelly. Paper read before Lake Superior Mining Institute, June 1909.
6. Sinking Reinforced Concrete Shafts through Quicksand. F. W. Adgate. Lake Superior Mining Institute, June 1909.
7. Concrete with Timber Reinforcement. Gerald O. Case. Society of Engineers, April 1912.
8. Reinforced Concrete Foundations for Stamp Batteries. S. J. Truscott and John P. Fuller. Inst. of Min. and Met., 1908.
9. Concrete in Mining and Metallurgical Engineering. H. W. Edwards. Trans., Amer. Inst. of Min. Eng., February 1904.
10. Concrete Shaft-Stringers. A. N. Wold. *Mining & Scientific Press*, Dec. 2, 1911.
11. The Rogers Concrete Drop-Shaft, Iron River, Michigan. P. B. McDonald. *Mining and Scientific Press*, December 30, 1911.
12. Concrete in Mines. W. R. Crane. *Concrete and Construct. Eng.*, March 1908.



- Johnson. *Eng. & Min. Jour.*, July 29, 1911.
15. Concrete in Mining. J. B. Landfield. *Mining and Scientific Press*, July 8, 1911.

16. Annales des Mines de Belgique, XVI, 425 and 473.

17. Concrete Floors for Shaft Stations. *Eng. & Min. Jour.*, Dec. 23, 1911.

18. Bulletin de la Société de l'Industrie Minière, Vol. IX, 1908.

19. Concrete in Inclined Shafts. Sheldon Smillie. *Eng. & Min. Jour.*, May 13, 1911.

20. Concrete. A. Delmar. *Mining and Scientific Press*, April 15, 1911.

21. Application of Concrete to Underground Work. H. T. Mercer. Lake Superior Mining Institute, 1912.

22. Reinforced Concrete as applied to Mine Shafts. *Mining and Engineering World*, May 25, 1912.

23. Concrete Shaft-Lining. F. E. Calkins. *Mining & Scientific Press*, Nov. 2, 1912.

Arkansas Diamond Mining.—As unprogressive Arkansas is to the progressive United States, Pike County is to Arkansas. This is simple proportion, but it may be a compound libel on Pike county, involving unjustly its inhabitants and resources. An analysis of the causes contributing to the obscurity of this region must lead to conclusions unflattering to the human factors, for available records of the natural resources should raise the county even to a dazzling position of economic fame. In 1908, Pike county, Arkansas, was credited with the ownership of a true diamantiferous pipe, containing stones of high quality, nearly as great in area as the deposit in the Transvaal, and capable of being exploited profitably. Messrs. G. F. Kunz, H. S. Washington, and J. T. Fuller were the responsible and trustworthy auditors certifying to the accuracy of this entry in the schedule of realizable assets. Since then, no information has been published requiring a revision of the original assessment. But how is it that the Arkansas diamond mine, which shot into prominence some five years ago, is today neither a productive enterprise nor a condemned and deserted property? In South Africa, for example, a supposed diamond mine is made or broken within twelve months after its discovery, even if local storekeepers and bank-clerks have to subscribe funds for testing operations. In America, not characteristically sluggish in mining enterprises of speculative novelty, we have in this particular case an undertaking not yet beyond the phase of original uncertainty, although presented years ago, except that doubtful ignorance is mellowing into blind scepticism through sheer lapse of time.

That there is a pipe of peridotite, of great extent, that this peridotite closely resembles South African kimberlite in texture and composition, that it is in part deeply oxidized and readily amenable to inexpensive treatment, that several hundred diamonds have been won from the area, that diamonds occur in the matrix, that working conditions are favourable, that considerable money was raised for exploitation, that a small plant was erected and that limited treatment operations have been performed in a desultory, unsystematic manner—these are the accredited facts we still find on record unassailed. The silence of years is thus astonishing.

The Arkansas company is not the only concern associated with this deposit. A small portion, of uncertain acreage, is held by the Ozark company, which, though controlling but a fraction of the pipe, appears to be a more active enterprise. A washing plant, of a novel type, has been erected on the Ozark property and is due to commence work shortly. Unfortunately this activity is in the wrong place and will not necessarily lead to any increase of our knowledge of the possibilities. The Ozark fraction is too small a marginal area to reflect the average conditions. Still, the owners are plucky and honest, deserving all encouragement where mining enterprise appears so frail a force. The Ozark mill is of a suitably small capacity (3000 to 4000 loads per month) and is the first diamond plant in the world to utilize, between crusher and jigs, the log-washer—familiar in iron-concentration—in place of rotary pans. The unexpected rise of the Ozark to a point of production may prove alone a small incident in the history of the Arkansas mine. It still remains for the major company to explain how this diamond-bearing pipe can be excusably allowed to remain so long—and perhaps falsely—among the idle rich. The Arkansas mine was introduced to the public with the best credentials, with satisfactory letters from Kimberley, with good financial recognition, and with a 'college degree.' It should now be cut adrift and made to work for a living or prove its inherent worthlessness by starvation. It is a poor diamond property that cannot hold its own, even with an initially imperfect equipment. If no effort be made, we shall be driven to conclude that the results obtained to date, though limited, were unfavourable after all. In time, there becomes little distinction in the restless and impatient industrial world between the mines that simply don't succeed and those that cannot.

PRÉCIS OF TECHNOLOGY

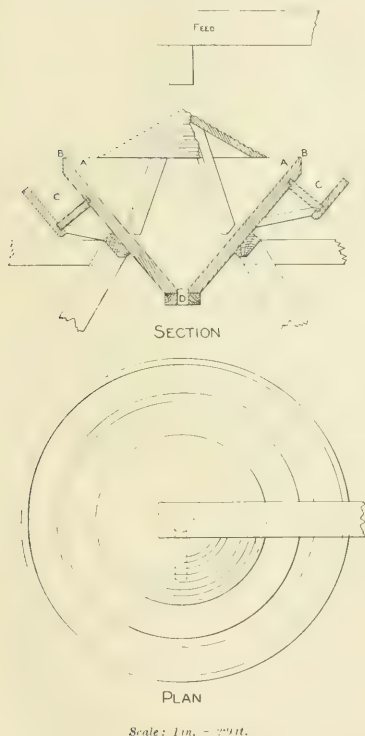
De Bavay's Process.—The owners of the De Bavay patents and process for concentration by flotation have never allowed an exact description of the working details to be published, owing to the long-standing disputes as to the ownership in the several countries of the patents governing the use of oil, aeration by agitation, acid, and surface tension. We therefore read with unusual interest the account given by T. J. Hoover in his book, a review of which appears in another column, and we herewith give an abstract of his des-

the recovery of lead sulphide. The tailing that settles is transferred to the oiling vat, where it is again agitated with water to which a definite proportion of oil has been added. The oil is a mixture of 1 part of castor oil to 4 parts of low-grade kerosene; 2 to 3 lb. of this is used to 1 ton of tailing. Some chlorine gas is also introduced. The oiled pulp is elevated in a monteju by means of compressed air to the first tier of separating cones. One of these cones is shown in the accompanying illustration. The pulp is fed to the top of the cone and flows down over a series of corrugations to the water-level A, where some of the sulphides float and pass over the lip B into the launder C. The remainder falls to the bottom of the box, passing through the orifice D to a second cone, where a further amount of the sulphides floats on the surface of the water. The tailing goes subsequently to a third and fourth cone, where the process is repeated. The function of the chlorine gas is obscure. The subjecting the pulp to compressed air is apparently an essential part of the operation. If so, the process is analogous to other oil-and-aeration processes. Mr. Hoover draws attention to the high initial cost of the plant. The capacity of each cone unit is low, and the plant is large and covers much ground. The new installation of the Amalgamated Zinc company at Broken Hill, to treat 1800 tons per day, cost no less than £200,000. No figures are available for the amount of slime discarded; all that is known is that the material is ground to pass 40-mesh. The tailing treated by the new plant comes from the North, South, and Block 10 mines; it is of high grade and does not contain much slime, and is in fact the best in the district.

Nigerian Tin.—*Economic Geology* for September contains an article by J. D. Falconer on the occurrence and origin of tin in Nigeria. Mr. Falconer was head of the Geological Survey that was instituted by the British Colonial office in 1904, and he is author of 'Geology and Geography of Northern Nigeria,' a book reviewed in our issue of January last. His views from the economic standpoint are of interest at the present juncture.

The tinfields of Northern Nigeria lie mainly on the summit and round the margin of the great central plateau. The cassiterite is found both in placers and in lodes, but practically all the concentrate produced has come from the former. The stream tin had been worked and smelted on a small scale by the natives for a lengthy period before the British occupation in 1900. In 1902 the Niger company started exploration work, and in 1904 the first mining camp was established under its auspices on the banks of the Delimi river, on the site of what is now Naraguta. Subsequent search has proved the presence of lodes in the vicinity of the placers, but little or no scientific study has been made of them. Some of the statements published in London have in fact proved quite devoid of foundation. As far as investigation has gone, there would appear to be some difference in the mineral content between the placers and the lodes, a difference sufficient to suggest that the original habitat of the placer tin has not yet been definitely ascertained.

Like most placers, the tin-bearing gravel of Northern Nigeria is believed to be of comparatively recent age, and to date from a period immediately preceding the establishment of the present river system. The placers are distributed over an area of about 9000 square miles, mainly in western Bauchi, but extending also into the adjoining provinces of Zaria and Nassarawa. The richer deposits are found in the valleys of western Bauchi, where the cassiterite has been concentrated by the present streams. Until recently only these



cription. The earlier De Bavay patents pointed to the application solely of the principle of surface tension, without the use of oil, acid, or aeration, but since then the value of oil has been recognized. In the process, as now applied, the zinc tailing is first de-slimed, then agitated with a cold acid solution to remove oxidation products and so to thoroughly clean the sulphide surfaces, and subsequently washed to remove all trace of acid. After this washing is complete, a small amount of scum of sulphide particles remains on the surface of the water; this is drawn off and sent to vanners for

richer areas have been worked, and the leaner deposits and the prospecting for lodes have been neglected, owing to the high cost of operations, especially in connection with transport. Now that railway and other communications have been improved, working conditions will be rather more favourable to the less profitable propositions.

In the richest places, the cassiterite is accompanied with a comparative abundance of white and yellow topaz, and of small pyramidal and octahedral crystals of brown zircon. These minerals may be taken as indicators. Along with these, small amounts of magnetite, ilmenite, rutile, garnet, and monazite are collected in the concentrate, together with occasional specks of gold. As a rule it is not difficult to obtain a concentrate assaying 70% tin. The cassiterite varies in colour from black to ruby or pale yellow, and assays about 75% metal.

The alluvial deposits are found in close association with extensive masses of alkaline granite, which have been injected into the surrounding gneiss and schist. It was, at an early date, suggested that the cassiterite of the gravel was probably derived from the granite, where it might be found either sporadically as a rock constituent or as stockworks on the margins of the igneous mass. It was not, however, until 1908, that the prospectors of the Niger company actually discovered it in the granite, in the neighbourhood of Naraguta, where it occurs, not according to the prognostication, but on the summit of the plateau and in the heart of the intrusive mass. The granite here shows signs of fracturing and fissuring, and of accompanying pneumatolytic action. The adjoining rock is chloritized and partly mineralized, and the fissures themselves are filled with stanniferous pegmatite and other vein-matter. The cassiterite is associated with various sulphides, such as pyrite, chalcocopyrite, tetrahedrite, blende, and galena, no trace of which is usually found in the placers. On the other hand the topaz and zircon are apparently absent from the lodes so far discovered, so that though they are also of pneumatolytic origin, their exact mode of occurrence in the granite remains doubtful. Of course other lodes may yet be discovered that will account for these two minerals. There is every reason to believe that the distribution of the lodes will be found to be as wide as that of the gravels.

The cassiterite in Bauchi province, in and around the plateau, and in the Lirue and Ningi hills to the north, is everywhere associated in this way with masses of uncrushed soda-granite. The small quantities that have been found in Yola province, and on the Cameroons border, are probably of similar origin. Cassiterite is also found in places as a constituent of some of the pegmatite dikes that are abundant in the gneiss and schist. These dikes are frequently rich in tourmaline, but whenever this is the case, they are, curiously enough, barren of cassiterite. The stanniferous and tourmaline-bearing pegmatite are similar in structure, and probably belong to the same general period of igneous activity as the larger masses of tourmaline and alkaline granite. Probably the tourmaline granite and pegmatite were formed during an early phase of this igneous period, while the emanations which gave rise to the metallic lodes and the stanniferous pegmatites were characteristic of an entirely distinct and later phase, posterior to the solidification of the larger masses of alkaline granite. It follows therefore that in Nigeria, the presence of abundant tourmaline in granite and pegmatite is no safe indication of the presence of cassiterite in the same neighbourhood.

Concrete Shafts.—The use of concrete in mining is extending and inquiries are continually being made for information as to practice. We therefore give details of the work done at the 2-compartment shaft at the United Globe mine belonging to the Old Dominion company, one of the Phelps-Dodge group, situated at Globe, Arizona, quoting from an article by F. E. Calkins in the *Mining and Scientific Press* for November 2. In October 1911, the timbering of this shaft was destroyed by fire. It was decided to replace timber by concrete, and to build the lining by lifts or sections, beginning near the top and working downward, the distance being 1017 ft. The work was accomplished in six sections, each from 150 to 220 ft. in height, depending on the condition of the ground. A month was spent in the preliminary work of erecting a temporary head-frame, crushing plant, concrete mixer, and other machinery, and in cleaning the charred timbers and loose rock from the first section, extending from the collar to a point 160 ft. below. Two heavy wooden cages, swinging freely in the shaft, were used throughout the work. In lining a section, the walls were stripped of charred timber and loose rock, beginning at the top and working downward, and light temporary sets of timber were put in, with some lagging wherever necessary, so that the men were always protected from falling ground. When the bottom of the section was reached, temporary timber bearers were placed along the sides and ends and across the centre of the shaft; forms were built upon them, and a permanent reinforced concrete bearer, 4 or 5 ft. high, was put in. Two or three days were allowed for this to set, after which the concrete lining was built on top of it. The forms were built in sections 12 ft. high, and the concrete poured in between the form and the rock walls of the shaft. As soon as one 12-ft. section was filled, another was erected on top of it, plumbed and blocked, and filled with concrete in the same manner. The work proceeded thus until the bottom of the finished lining above was reached, the temporary timbering being removed as fast as the forms were erected.

The concrete was made to run from the conical mixer into a hopper and down the shaft through a 4-in. iron pipe to the point where it was needed, where it was caught in an ordinary steel sinking-bucket suspended from the finished portion of the lining above, and allowed to run through a hole cut in the side of the bucket a few inches above the bottom, and through a short steel chute into the forms. This was a very efficient and flexible arrangement, as the bucket could be easily swung or turned, and a continuous stream of concrete directed to any part of the forms desired. The concrete was successfully dropped in this manner for a distance of over 1000 ft. in building the last section.

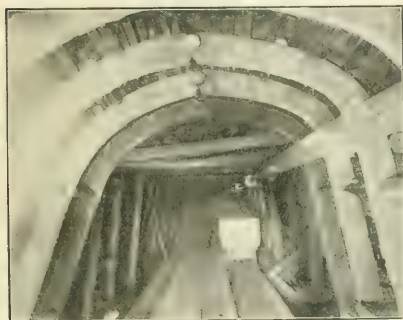
The long walls of the lining were given a minimum thickness of 10 in., and the short walls and centre wall 8 in. Where the rock walls were irregular, forming hollows, large rocks brought down on the cages were thrown into the concrete. The centre was reinforced every 18 in. vertically with mine rails laid across the shaft in the centre of the wall. The end and side walls were reinforced in this way only at points where the ground was bad and at stations. Bolts were imbedded in the concrete at regular intervals for fastening the guides.

The concrete was a 1:3:6 mixture of portland cement, quartz sand, and crushed limestone from $\frac{1}{4}$ to 1-in. size. About 2300 cu. yd. of concrete and 750 cu. yd. of large rock were used. The time occupied was 8 months, of which the first month was spent in erecting the surface plant, cleaning the walls, and putting in temporary timbering preparatory to concreting.

Also, the lower 110 ft. of the shaft consisted of a rise of one-compartment size, and this had to be enlarged to full size. The actual work of concreting was done in 100 days, or about 40% of the total time consumed. Ordinarily, one 12-ft. section of concrete per day was put in, but in bad ground a 6-ft. form would be used. The maximum day's work was 22 feet.

The two compartments are 5 by 7 ft. 2 in. inside the finished lining, and the shaft will be used only for ventilation and for hoisting and lowering men working in the east end of the mine. It is interesting to note that the area of the compartments is over 60% greater than the area of the old timbered compartments, which were 4 by 5½ ft., showing that with a given area of ground broken a much larger shaft-area may be obtained with a concrete than with a timber lining.

Ferro-Concrete Mine-Supports.—The *Iron & Coal Trades Review* for November 15 describes the Klingelhoefer ferro-concrete mine-support which is being tried at several German coal mines. The sup-



port is made in two halves, in the form of an arch, united with a hinged joint at the crown. The feet are set on a sloped portion of the floor. By this arrangement, the arch can give a little under either vertical or lateral rock-pressure, so that the pressure can be distributed throughout the structure more evenly. The elasticity of the support is increased by making the joint-pin of wood or other compressible material. It is claimed that the members are easily made and erected; and that owing to their curved shape it is not necessary to trim the corners of the levels so exactly as with rectangular frames, thus reducing the cost of working.

Low-Speed Chilean Mills.—The use of low-speed Chilean mills for comminuting gold ores has received attention recently, and several papers have been read on the subject. It is of interest therefore to quote the results obtained at the Minnesota mine at Maitland, in the Black Hills district of South Dakota, as recorded by Jesse Simmons in the *Mining and Engineering World* for November 2. The ore at this mine is first reduced to 1½ in. in an Austin crusher, then sent to two sets of rolls measuring 14 by 30 in., where it is reduced to ½ in. Cyanide solution is afterwards added and the pulp delivered in launders to two Chilean mills. One pair of rolls and one Chilean mill form a unit operated separately, each unit being driven by a 50-h.p. electric motor. Experiment has shown that 20 h.p. is sufficient when the plant is running continuously, and the reserve of power is only required to re-start, should

the Chilean mill stop while full of pulp. Each Chilean mill is 10 ft. in diameter, with 6 rollers, which with new tyres weigh 4000 lb. each. The usual speed is 11 revolutions per minute. The discharge from the mills is much finer than with stamps. With a 6-mesh screen and the discharge 5½ in. above the tread, the fineness of the discharge is as given in the following table:

On 20 mesh.....	0.9
.. 40 ..	6.2
.. 60 ..	11.1
.. 80 ..	10.1
.. 100 ..	10.5
.. 150 ..	15.0
Through 150 ..	46.2
	100.0

The ore is mostly a hard and tough quartz, with a small proportion of softer material. The capacity of each mill is 70 to 75 tons per day. No amalgamation is done, but as already stated, the solution in the mill contains cyanide. The discharge is classified into sand and slime and the two products are cyanided separately. The total cost of milling and cyaniding works out at \$1.23 per ton.

Tellurides at Kalgoorlie.—The *Monthly Journal* of the Chamber of Mines of Western Australia contains an important article on this subject by J. Allan Thomson, who assisted J. Malcolm MacLaren in his study of the Kalgoorlie ore deposits two years ago. The tellurides identified in that district are: calaverite, sylvanite, krennerite, petzite, hessite, coloradoite, altaite, melonite, and rickardite; and other associated minerals are: tetrahedrite, chalcocopyrite, bornite, magnetite, roscobelite, and free gold. The tellurides are for the most part confined to the richer shoots in the large lodes in the 'golden mile'; outside of this they have been found in important quantities in the Block 45 and Eclipse leases of the Oroya Links, and in the Hidden Secret mine. From the mineralogist's point of view, the ore-shoot at the 400-ft. level of the Kalgurlie mine

and that in the Hidden Secret are the most interesting, owing to the large variety of minerals found intermixed, there being also present many oxidation products difficult to determine. As a rule, the tellurides occur in veinlets crossing the lodes at right-angles, and most often with quartz and carbonates. On breaking the rock, the fracture frequently runs along one of these veinlets, so that the tellurides appear to occur in patches. The tellurides, as well as the tetrahedrite, chalcocopyrite, and bornite, have no crystalline structure, and they are moulded on the quartz or carbonates, pyrite or magnetite, which have been crystallized in the veinlets. In consequence, small crystals of quartz and pyrite project through or appear to be embedded in the tellurides. Free gold is often associated with them, especially with coloradoite, either as thin scales on their surface, tiny veinlets ramifying through them, or embedded in the quartz-carbonate mosaic. It is usual to find two or three tellurides in each specimen, and sometimes the interpenetration is minute, leading to difficulties in discrimination. In fact, it has been found almost impossible to obtain each mineral without some admixture of the others, except by picking out separate grains under the microscope.

With regard to the individual minerals, the author reports that the calaverite corresponds closely to the theoretical formula Au Te_2 , though containing always small amounts of silver, the colour being the usual pale bronze-yellow. As regards the sylvanite and krennerite, it has not been possible to separate these

owing to the identity of their silver-white colour, their similar cleavage, and the absence of crystalline form. The author takes the sylvanite to be represented by the specific formula Au Ag Te_4 , and the krennerite by the general formula $(\text{Au Ag}) \text{Te}_3$, the relative amount of silver being a variable quantity and less than in sylvanite. Petzite is a gold-silver telluride of steely to black colour, containing much more silver, the analysis approximating to the formula $\text{Au Ag}_3 \text{Te}_2$. Owing to its similarity to coloradoite, it has been difficult to obtain it in a pure state at Kalgoolie. Hessite is usually supposed to be a telluride of silver having the composition Ag Te_3 , but most analyses show gold; this is owing probably to the presence of petzite. No analysis has been made of hessite obtained at Kalgoolie. Its colour is a leady grey. Coloradoite is a telluride of mercury, Hg Te , of similar colour to petzite, and the analysis of the specimen obtained at the Great Boulder Main Reef showed this composition. Another analysis, on a specimen from the Associated mine, showed a smaller content of mercury, corresponding to the formula $\text{Hg}_2 \text{Te}_3$, but this is not the usual form. Altaite, the telluride of lead, has been found at the Great Boulder Proprietary, Eclipse, and Hidden Secret; and monelite, the telluride of nickel, and tetradymite, the telluride of bismuth, have been found at the Hidden Secret. Rickardite, the telluride of copper, has been found at the Kalgurli mine. This contains free gold in the form of fine intricate veins, not visible until treatment with nitric acid. Two varieties of this mineral have been found there. One has a very fine fracture and a black metallic colour, and it often has leaf-like films of gold between the cleavage planes. The other is coarser and of a greyish-metallic appearance with a distinct cleavage; the included gold is not so finely distributed. The colour is different from that of the rickardite found in Colorado, which was a deep purple, though the tarnished surface will sometimes acquire this shade. The author considers the minerals named by other investigators, goldschmidtite, kalgoolite, and coolgardite, to be mixtures, the first of various gold and silver tellurides, and the second and third of gold, silver, and mercury tellurides.

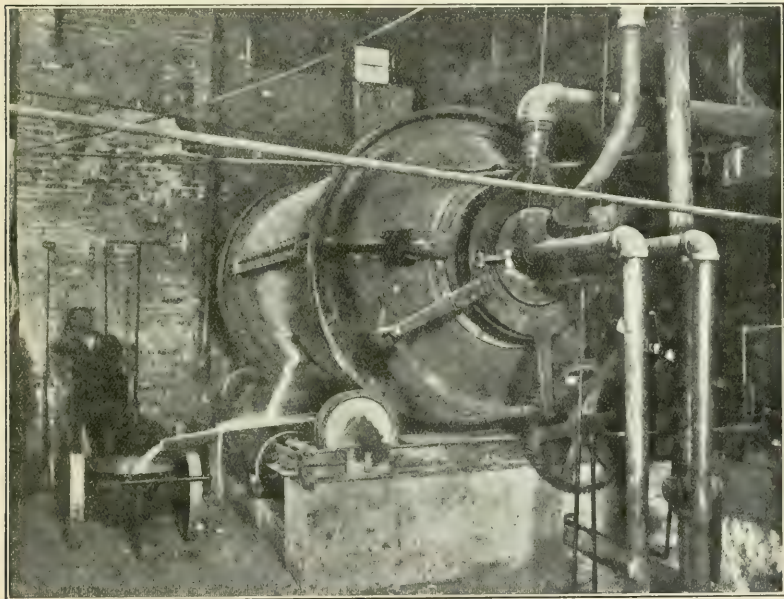
Exothermic Steel.—The September, October, and November issues of *Metallurgical and Chemical Engineering* contain a discussion relating to a direct process for making steel, in the course of which the reaction is alleged to give out much heat, that is to say, to be exothermic. The steel is a special trade product invented by George Fogler, and the description was written by W. O. Amsler in the September issue of the periodical named. Mr. Amsler is apparently a scientific man, for he owns the degree of D.Sc. Nevertheless his article must be taken as either a colossal blunder or a practical joke played on the editor. He states that a mixture of felspar, bauxite, and lime acts as a reducing agent on iron oxide, thus producing metallic iron, and at the same time liberating much heat. The aluminium contained in the bauxite and felspar is said to provide the reducing power. The author gave elaborate equations explanatory of the succession of reactions, and for a short time he succeeded in throwing dust in the eyes of the professional world. However, the nigger in the wood-pile was soon discovered, in the form of an extra atom of aluminium with which the author had endowed his felspar, his formula for the mineral being $\text{K Al}_2 \text{Si}_3 \text{O}_8$ instead of $\text{K AlSi}_3 \text{O}_8$. No doubt that extra atom was responsible for the exothermic reaction. But as Joseph W. Richards said in the discussion, the statements are "mere bosh," and may be dismissed without further discussion.

Electric Zinc Furnaces.—In *Metallurgical and Chemical Engineering* for November, Francis Louvriér discusses the comparative failure of electric furnaces designed for the reduction of zinc ores. The author has, as recorded in our issue of September 1911, devoted much attention to the subject, and is the inventor of a furnace that is used on the continent of Europe. All furnaces so far used have been faulty in the condensation of the zinc vapour into liquid metal, with the consequent production of a large proportion of blue powder. The cause of this extensive formation of powder is undoubtedly the higher percentage of carbon dioxide present in the gases issuing from electric furnaces. The author has made a special study of this phenomenon. The theoretical reaction in the furnace consists of the formation of zinc and carbon monoxide, but there is an intermediate production of carbon dioxide due to the reaction of zinc oxide and carbon monoxide. The dioxide thus formed is or should be converted again to monoxide by a further reaction with carbon. The last reaction is never actually complete, and its relative completeness varies with the type of furnace. In ordinary retorts the reduction of the zinc oxide is conducted slowly, and at uniform temperature, so that the carbon dioxide is in contact with the hot carbon for a comparatively long period, thus ensuring its fairly complete transformation into monoxide. The amount of dioxide passing into the condenser is therefore small, and little interference with the condensation is occasioned. In the electric furnace, on the other hand, the temperatures are uneven throughout the charge, and the production of carbon dioxide is locally rapid. It is clear that there must be a narrow zone in the immediate vicinity of the source of electric heat, within which the temperature is higher than is actually required for the reaction. This causes a rapid reduction of the zinc oxide and evolution of carbon dioxide. The latter immediately escapes into a colder zone where it has not full opportunity to react with the carbon. In attempting to remedy this defect, many propositions have been made for forcing the gases and vapours through another chamber containing incandescent coke, but the results are almost entirely negative. The author is of opinion that the final transformation of the dioxide into monoxide must be effected within the actual furnace, and at a place not far distant from the original point of reduction of the zinc oxide. Thus, in future experiments and researches, the goal to be attained is the more equable distribution of heat throughout the charge.

Ancient Bronze.—The annual Huxley lecture for 1912 of the Royal Anthropological Institute was delivered recently by William Gowland, who, besides being an eminent metallurgist, is an antiquary of distinction. The lecture was on 'The Metals in Antiquity,' and it contains a valuable record of the earliest uses of metals. Two of his points in connection with bronze are worthy of notice here. One refers to the production of bronze in one smelting operation on a mixture of tin and copper ores. He shows that during the early metal age, and even later, bronze was not obtained by melting metallic copper and tin together, but by the reduction of oxidized copper ores containing cassiterite, or of copper ores to which cassiterite ore was added. It is important that this fact should be recorded, seeing that some metallurgists allege that such a process is impossible, and that whenever tin and copper ores are smelted together the tin does not unite with the copper but passes into the slag. These allegations are not founded on experiment, but on erroneous deductions from the methods of smelting

in use at the present time. In order to determine the possibility of producing a bronze direct, Professor Gowland constructed a simple furnace consisting merely of a hole in the ground. In this he treated a mixture of 15 lb. of green carbonate containing 30% copper and 10 lb. of a cassiterite ore containing 20% tin, together with charcoal and limestone. An analysis of the metal produced showed 78% copper and 22% tin. A series of experiments were undertaken with varying proportions of the ores, and in every case copper-tin alloys were obtained. The second point raised by Professor Gowland referred to the supposed lost art of tempering bronze. In the old days the bronze castings for tools, weapons, etc., were hammered at

Many mechanical alterations have been made in the design of the furnace, and it is claimed that the past difficulties have been overcome. The object of the invention is to treat zinciferous copper-iron sulphide ore or concentrate in such a way as to recover the zinc, or at any rate to remove it quickly without it clogging the smelting re-actions or getting into the slag. His furnace is designed on the lines of a horizontal revolving cylindrical converter with conical ends, and may be described as a combination of a reverberatory and a converter. The raw ore or concentrate is fed in at one end through the stationary centre, by means of the curved pipe shown in the illustration, as also is a spray of oil-fuel and air. In the stationary centre is a



THE FINK FURNACE.

the cutting edges to produce the right degree of hardness and temper. No other method was ever employed, such as heat treatment. The same effect can be produced on modern bronzes by hammering, and in fact an even greater hardness can be obtained. Thus the notion that the ancient art of tempering bronze has been lost is a fallacy.

Fink's Smelting Process.—From time to time during the last few years, mention has been made in the American press of the new process and furnace invented by Edward Fink, but as details have been lacking and as the experimental plant at Garfield, Utah, was a failure, we have not hitherto been able to say anything about it in our columns. The inventor has now broken silence and published a description in the *Mining and Engineering World* for November 2.

wind-box which is supplied with hot air-blast through the two pipes in the foreground. Blast is distributed from here to the oil-burner and also to two sets of tuyeres, one row of which is shown extending along the cylindrical portion of the furnace. The first action in the furnace is that of a reverberatory, in addition to which the blast from the tuyeres serves to volatilize the zinc as oxide, and to bespatter the lining with silicious matte. The revolution of the furnace prevents the local corrosion of the lining, especially around the tuyeres, and also effects a stirring of the charge. The slag is tapped from time to time, and when sufficient matte has accumulated, the oil-spray is put out of action, and the process becomes one of bessemerizing, the eventual product being therefore a blister copper.

CURRENT LITERATURE.

Stockfish System of Shaft-sinking.—The *Colliery Guardian* for November 1 contains a translation of an article in *Gluckauf* describing the Stockfish system of sinking shafts through wet sand. The plant is similar to a drilling-rig, with percussion tools and water-flush.

Concrete in Mining.—The *Mining and Engineering World* (Chicago) for October 26 reprints a paper read by H. T. Mercer before the Lake Superior Mining Institute, describing applications of reinforced concrete in the construction of mine-shafts.

Concentration of Iron Ore.—*Metallurgical and Chemical Engineering* for November contains an article describing the concentration plant of the Oliver Iron Company, on Trout lake, near the western end of the Mesabi range, Minnesota. The capacity of this plant is 35,000 tons per day. The ore as it comes from the pits contains from 35 to 42% iron, and after the removal of the silica, the concentrate averages 57% iron. The plant is arranged in five units, each treating 350 tons per hour for 20 hours during the day.

Concentration at Bleischarley.—*Gluckauf* for November 16 and 23 contains a description of the new concentration plant for treating zinc-lead sulphides at Bleischarley, Upper Silesia.

Research on Gold Ores.—The September *Journal* of the Chemical, Metallurgical, and Mining Society of South Africa contains a paper by Morris Green, describing his investigations in connection with the gold ore found at the Mount Morgan mine in the Barberton district of the Transvaal. The ore is pyritic and contains carbon, and had long resisted all attempts to treat it. Mr. Green gives in great detail the methods of analysis adopted by him, and describes the method of treatment eventually recommended. The paper is an excellent record of research work.

Cyanide Assay.—In the *Mining and Scientific Press* for November 9, P. L. Guppy and Douglas Waterman give a method of estimating the amount of lead, zinc, and copper in cyanide solutions produced in the treatment of silver-sulphide ore.

Analysis at United States Mints.—The *Mining and Engineering World* contains an article by Harold French, formerly chemist at the San Francisco mint, describing modern volumetric methods of analysis used at United States mints.

Sampling Gold Bullion.—The October *Bulletin* of the American Institute of Mining Engineers contains a paper on the sampling of gold bullion, by F. P. Dewey, assayer to the United States Mint.

Homestake Metallurgy.—At the November meeting of the Institution of Mining and Metallurgy, an elaborate paper was presented by A. J. Clark and W. J. Sharwood describing the metallurgical plant of the Homestake gold mine, South Dakota. Amalgamating plates of large area are still used at this plant.

Cananea Copper.—The *Mining and Scientific Press* for November 2 reprints L. D. Ricketts' report on the work done during 1911 at the mine and smelting plant belonging to the Cananea company, Mexico.

Alumina in Slags.—The October *Bulletin* of the American Institute of Mining Engineers contains a paper by J. E. Johnson on the effect of alumina in blast-furnace slags in connection with iron metallurgy.

Converter Practice.—The *Mining and Scientific Press* for November 2 reverts to the history of the development of the converter as applied to copper metallurgy, and reprints the paper by the original inventor, the late John Hollway, published in 1879.

Reverberatory Furnaces.—The *Mining and Scientific Press* for November 9 reprints E. P. Mathewson's paper on the development of the reverberatory copper-smelting furnace, read at the International Congress of Applied Chemistry, held in New York in September last. Details are given of the work at Anaconda, Cananea, Great Falls, Garfield, Steptoe, Tooele, and Kyshtim.

Zinc Distilling in America.—In the *Mining and Engineering World* for November 9, C. L. Bregier describes the new zinc-distilling plant erected at Hills borough, Illinois.

Ore in Depth.—In the *Mining and Scientific Press* for October 26, J. Malcolm Maclaren adds to the discussion on T. A. Rickard's paper on the persistence of ore in depth. His argument is that it is not so much the depth that has to be considered as the variation in the nature of the country rock through which the lode passes. Owing to the recognized depletion of the outcrop orebodies, Mr. Maclaren's view may be taken as an encouragement to search for hidden orebodies.

Saddle-Reefs at Hargraves, N.S.W.—In the *Mining and Engineering Review* for October 5, J. Bowie Wilson describes the saddle-reef formation at Hargraves, New South Wales, 150 miles northwest of Sydney. This district in early days was an important goldfield.

Replacement.—In *Economic Geology* for September, Waldemar Lindgren reverts to the discussion on replacement orebodies, with special reference to J. D. Irving's articles on the subject. He introduces the question of the environment of the replaced mineral or rock, discussing it under three heads of reactions, (1) in open spaces, (2) in yielding material, (3) within solid rocks.

Potash from Rocks.—*Metallurgical and Chemical Engineering* for November contains a number of papers describing the various attempts to extract useful potash salts from igneous rocks.

BOOKS REVIEWED

CONCENTRATING ORES BY FLOTATION. By Theodore J. Hoover. Cloth, octavo, 230 pages, with many illustrations. London: *The Mining Magazine*; San Francisco: *Mining and Scientific Press*. Price 12s. 6d.

This book may be said to rank in importance with Dr. Peters' original edition of 'Modern American Methods of Copper Smelting' and with the earlier books, pamphlets, and articles on the cyanide process, notably those of Scheidel and Butters & Clennell. Dr. Peters disclosed for the first time the methods adopted in the United States for smelting copper ores, in some cases re-inventions of old practice, and oftener based on new ideas, but all of them devised for the purpose of fighting the secrecy of South Wales. The early publications on the cyanide process belonged to a different category, for they divulged information relating to the successful results obtained by a new application of a known chemical principle. The flotation of metallic sulphides and their preferential affinity for oily substances may be compared from the historical point of view to the modern reverberatory practice in connection with copper, and to the dissolution of gold by cyanide. It was all known before, long ago. The early copper practice was a success but was kept secret, and the analogy does not therefore hold, but the attempts to apply the cyanide reaction were all failures until MacArthur and Forrest showed the virtue of their special application of weak solutions. Similarly, the ancient Greeks used to catch float-gold by means of a greasy feather;

Haines, an engineer working in the Flintshire lead and zinc district fifty years ago, was aware of the attraction of sulphides to oily substances; Carrie Everson, an American school teacher, found in 1885 when washing her brother's ore-bags that the sulphide removed in the laundry floated on the surface of the water as a scum. In 1894 Robson and Crowder conducted experiments in Wales, but without success. It was not until 1898 that the possibilities of oil flotation were brought prominently before the metallurgical world. This was done by the Elmore's with their heavy-oil process. In 1902 Potter's discovery of the efficacy of hot acid was made. Subsequently multitudes of patents have been obtained by other investigators, and the discussions as to the rival claims of oil, gas, air, surface tension, agitation, etc., and their combinations have served to confuse rather than to elucidate the principles of flotation, for the public utterances and writings relating to the subject, by those fully acquainted with the subject, have always been cryptic and often misleading, owing to the delicacy of the interpretation placed on the various operations by the various patentees. On the other hand, the many articles that have been written by disinterested engineers and by journalists have generally failed to be convincing, because the writers have not been in the inner councils of the operators, and on occasion their statements in the press have been unconscious distortions of fact. Some authors of high standing have even made ludicrous blunders in describing flotation processes.

The above may appear to be a long preamble to the review, but it serves the purpose intended, that is, to emphasize the fact that Mr. Hoover's book presents for the first time an authoritative record of the modern developments of the principle of concentration by flotation. Other publications have been either at second-hand or have been *ex parte* statements. Mr. Hoover for four years was the engineer to the Minerals Separation company and while so engaged he devised several of the mechanical methods that made this particular process a practical success. He is the first person thoroughly acquainted with the subject and unconnected with the actual ownership of patents to give his knowledge to the public. Owing to his past connection with the Minerals Separation company, the preparation of this book has bristled with difficulties. Professional rectitude forbids the divulgence of information gathered during a confidential connection, if such divulgence should be inimical to the interests of the former employer. We consider that these rocks have been skillfully avoided. The book is published by the consent of the Minerals Separation company, after the text had been carefully read; although there is reason to believe that they are not in agreement with all the views expressed by the author. From the point of view of the profession we ought to say, however, that this avoidance of an interference with the interests of the Minerals Separation company has had the effect of repressing or even altering many personal views and opinions of the author and of leaving deductions from statements of fact to the intelligent reader.

Mr. Hoover starts with a historical sketch of all the processes connected with the affinity of oil for metallic particles and sulphides and with the buoyant power of the various factors in flotation. Then he gives a list of the patents issued in various countries. The third chapter contains full details of the many lawsuits; the fourth deals with the theories propounded to explain the phenomena, and the fifth with the methods of testing the applicability of the processes to

the various classes of ore. Subsequent chapters describe in detail the many processes that have been introduced or proposed, namely, the Potter-Delprat, Elmore, De Bavay, Minerals Separation, Macquisten, Murex, Hyde, and others. The last chapter contains a discussion of the economics of flotation and of the applications of this type of concentration process. An unusually full bibliography completes the book.

Naturally the section dealing with the Minerals Separation process demands chief attention, partly because it contains the author's own experience and partly because this process is, at the present time, the most successful. The working drawings and detailed description of the plant are excellent guides to those desirous of putting the process into practice. The next most important chapter is that dealing with the theory, and we intend next month to quote some of the subject-matter in our *Précis of Technology*. Some of the disclosures contained in the book are in the nature of surprises. For instance, the author shows that the De Bavay process, though ostensibly founded on surface tension, makes use also of oil and aeration. For this reason we have reproduced his description of the process in this month's *Précis of Technology*. Another interesting disclosure is that some gangue minerals have a tendency to float, fluorspar being a notable offender in this way. This fact explains why zinc sulphide ores containing fluorspar have not proved amenable to flotation, and shows up the various specious explanations of cases of failure that have been proffered.

We feel bound to say that flotation is little understood by most mining engineers and for this reason we consider that Mr. Hoover has done an excellent service in stating the facts so thoroughly and completely. But this is not all; he has published many records, which, though not private and confidential, were previously not generally known. These are in the nature of an undercurrent that will help to provide an intelligent judgment as to the true inwardness of things. And they will show to the shrewd observer that the end of litigation is not yet; wishing to preserve an independent attitude, we shall not pursue this aspect of the matter. It is not out of place to say that before long the author will be free to publish further information and to give us more of his own independent judgments. E.W.

GEOLOGY AND ORE DEPOSITS OF BUTTE DISTRICT, MONTANA. By Walter Harvey Weed. Cloth, quarto, 260 pages, with many maps and illustrations. Washington: United States Geological Survey.

This important contribution to economic geology has been long awaited. Publication was delayed by the litigation between companies operating in the district, for the Geological Survey was under promise not to use the data gathered during the investigation until such time as it could not be used by the litigants. The work on which this monograph is based was started in 1896 by S. F. Emmons, assisted by W. H. Weed, but the latter was given full charge in 1901. As now given to the public it represents the laborious and systematic study for which the American Survey has won a deserved reputation. Only by correlating a multitude of observations was it possible to ascertain the structural relations of the lodes and the rocks traversed by them. The prevailing rock is a homogenous granite affording no clue to the measure of the faults that form so prominent a characteristic of the local geology. However, by careful noting of the position of the aplite and rhyolite intrusions, in conjunction with the identification of displaced portions of individual veins,

it has been found practicable to unravel a complex series of faults and to ascertain the relative age of the successive dislocations. Early in the volume we note the use of 'ledge,' an American provincialism for which there is no excuse. The brief outline of the history of Butte is interesting, as it affords a striking example of transition from gold to silver, and from silver to copper, mining. The name is derived from The Butte, a sharply conical hill of rhyolite, prominent in the local topography. The successive predominance of gold, silver, and copper, each in turn, is a feature that renders the early history of the Butte district peculiarly interesting. Something is said on the subject, but not in an illuminating manner. We note an error in Clayton's name and a confusing reference to the Comstock, which was discovered several years before the beginning of mining at Butte. The résumé of the statistics lacks coherence. It appears to consist of fragments written at different periods. An important feature of the introduction is the reference to Butte's future. It is stated that "the quartz-pyrite veins are becoming exhausted with depth; the amount of glance is decreasing, but the limit of workable ore has not yet been reached." The increase of enargite at the deeper levels "gives hope that the mineral may extend downward for several hundred feet." It is predicted that "the output of the district will remain constant for some years to come and will then gradually and slowly decline." The use of "some" is most unscientific. Surely the output is dependent upon the price of copper, by determining the grade of ore it is profitable to extract. A mention of zinc and of flotation processes is significant, as suggesting the beneficiation of the slime that now goes to waste from the big concentrating mills.

The monograph is remarkable for the detailed unravelment of the complicated fault system, to which is due much of the litigation for which Butte has been unhappily famous. The structural geology deciphered, in consequence of the elaborate investigations required to obtain evidence in lawsuits, has proved of the greatest scientific value. It serves once again to prove Emmons' insistence upon structural relations as a guide to the economic study of ore deposits. The excellent drawings and diagrams, with photographs, illustrate the amazing intricacy of the vein-structure, dislocated by repeated faulting, and do credit to the geologists who untangled the complex. It would have been well to add a chapter on the litigation, explaining its effect on the mining operations and the useful part it played in suggesting the exploratory work that led to the finding of important orebodies.

T A R.

COLLIERY WORKING AND MANAGEMENT. By H. F. Bulman and R. A. S. Redmayne. Cloth, octavo, 310 pages, with many illustrations. London: Crosby Lockwood & Son. Price 5s. For sale by *The Mining Magazine*.

This book was originally published in 1896 at the price of 18s. The authors have now published it at a much lower price, five shillings, for the benefit of the average colliery worker. The subject matter deals solely with the methods of developing a coal seam, winning the coal, and the arrangements for labour and wages. These questions are discussed in greater detail than in any other similar publication. No reference is made to pumping, hauling, hoisting, ventilating, and lighting. The nomenclature is parochial, and the descriptions are therefore difficult to follow by those unaccustomed to details of English practice, in spite of a glossary at the end.

THE MINERALOGY OF THE RARER METALS. By Edward Cahen and William Ord Wootton. Leather, pocket size, 230 pages. London: Charles Griffin & Co. Price 5s. For sale by *The Mining Magazine*.

This book is a valuable addition to the technical library, for it fills a distinct want. Other books on the same subject have been either incomplete and unreliable, or too strictly mineralogical. The title of the book is not sufficiently descriptive, for it has a much wider scope than mineralogy, including, in addition, the uses of each element and its compounds, the methods of testing the minerals, and the market value and prices current. The importance of the rare elements in commerce and industry is well known, and the number of prospectors in search of minerals containing, for instance, such metals as tantalum and cerium must be great. To such people the concise and clear information contained in this volume will be of great assistance.

UTILIZATION OF PEAT FUEL FOR THE PRODUCTION OF POWER. By B. F. Haanel. Paper covers, octavo, 140 pages, illustrated. Ottawa: Government Printing Bureau.

This is one of the publications of the Department of Mines, Canada, and contains valuable information relating to the production of gaseous fuel from peat.

THE DESIGN OF STEEL MILL-BUILDINGS. By Milo S. Ketchum. Cloth, octavo, 560 pages, with many illustrations. New York: McGraw-Hill Book Co.; London: Hill Publishing Co. Price 17s. For sale by *The Mining Magazine*.

A few months ago we reviewed Mr. Ketchum's new book on the design of mine structures. Now we receive a third and revised edition of his older and highly successful book on steel buildings. The new edition contains much additional matter and extensive revisions. Though not intended primarily for the mining engineer, the book contains a vast amount of information useful to him. The various chapters deal with buildings for all industrial purposes, the construction of walls, roofs, foundations; roof-coverings, floors, windows and skylights, ventilation, warming, paints, and multitudinous other details. The whole theory of design is given, and also estimates of cost of construction and erection. Altogether it is an admirable book.

PITMAN'S DICTIONARY OF SECRETARIAL LAW AND PRACTICE. Vol. I. Edited by Philip Tovey. Quarto, paper boards, 124 pages. London: Sir Isaac Pitman & Sons. Price 2s. 6d. For sale by *The Mining Magazine*.

This dictionary is being published in six fortnightly parts at 2s. 6d. each, and will subsequently appear in book form. We give this preliminary notice, leaving a considered review until the whole of the work has been issued. Though intended chiefly for the secretaries and other officials connected with company administration, it is of equal value to mining engineers and to shareholders in mining companies. Company law is complicated, and the various laws and rules of practice are difficult to unravel to both layman and professional. The idea therefore of classifying everything in dictionary or encyclopedia form is excellent. It renders reference to any particular subject quite simple. The editor, Mr. Tovey, is already known as an author of several useful books connected with the interpretation of company accounts; others who have assisted in the preparation of the work are F. Gore-Browne and F. W. Fixley. These names are sufficient indication of the status and reliability of the new publication.

COMPANY REPORTS

Mount Elliott.—This company was formed in London in 1907 to acquire the Mount Elliott copper mine, situated 70 miles to the south of Cloncurry, North Queensland. The first arrangements for smelting the ore were not satisfactory, and on the subsequent appointment of W. H. Corbould as manager, extensive rearrangements were made. The remodelled plant commenced work in 1910, and the first dividend was paid a year ago. The report now issued covers the year ended June 30 last, and shows that operations were curtailed by two labour strikes and also by a creep in the upper levels. During the 256 days the treatment plant was in commission, 39,933 tons of ore was smelted yielding 5286 tons of blister copper containing 9419 oz. gold and 7320 oz. silver. The receipts from the sale of blister copper were £407,066. The cost of mining and smelting was £166,787, freight and realization charges £54,333, proportion of expenditure on plant etc. written off £14,134, and administration expenses £7700; the profit was £158,443, out of which £110,638 was distributed as dividend being at the rate of 15% on the issued capital. Development has been centred on No. 5 level during the year and an important discovery of high-grade ore has been made on the southwest cross-cut. The ore-reserve on June 30 was estimated at 70,000 tons averaging 10 to 12% copper down to No. 4 level, and 35,000 tons of the same grade on No. 5 level; in addition there is 350,000 tons of concentrating ore averaging 3%. At one time a proposition to amalgamate with the Hampden Cloncurry company was discussed, but terms could not be arranged. The policy is now to acquire other properties and prospects. The most important so far of these is the Consols, at which 15,000 tons of 10 to 12% ore has been proved.

Tasmanian Copper.—This company was formed in 1897 under local laws, to acquire the Rosebery mine, on Mount Black, in the North Dundas district of Tasmania. The deposit consists of complex lead and zinc sulphides carrying gold and silver. Great difficulty has been experienced in devising a satisfactory method of metallurgical treatment. Finally, two years ago, a contract was made with the Tasmanian Metals Extraction company, which has erected works near the mine to conduct the bisulphite process (see our issue of November 1911). Owing to the unpreparedness of this process, the contract has not yet been commenced, and the parties went to law over its enforcement. The latest news is that the Extraction company has promised to start smelting at the beginning of 1913. The reserve at the mine consists of 250,000 tons of ore above No. 6 level, all blocked out and ready for immediate stopping. In addition, there is much proved and probable ore below this level.

Gwalia Consolidated.—This company was formed in 1898 to acquire the Star of Gwalia, a gold-mining property adjoining the Sons of Gwalia, in the Mount Margaret district of Western Australia. As this was not a success, the Lake Violet property in the Lake Way district was acquired. This has also not come up to expectations, for the ore is refractory and much of it is of low grade. Bewick, Moreing & Co. are the general managers, and Hooper, Speak & Co. are the consulting engineers. As recorded last year, many attempts have been made to evolve a sufficiently cheap process for the treatment of the ore. Ordinary roasting and cyaniding would be the ideal process, but the high price of fuel is prohibitive. The report now issued, covering the year ended June 30 last, but containing news up to November 25, shows that the modi-

fied roasting process tried in July of this year has not proved a success. Subsequently Ben Howe, the new manager, evolved a process based on volatilization and has obtained a 92% extraction. This process is to be further tested in an extended plant, and the necessary capital required therefor is to be raised by a scheme involving the re-construction of the company.

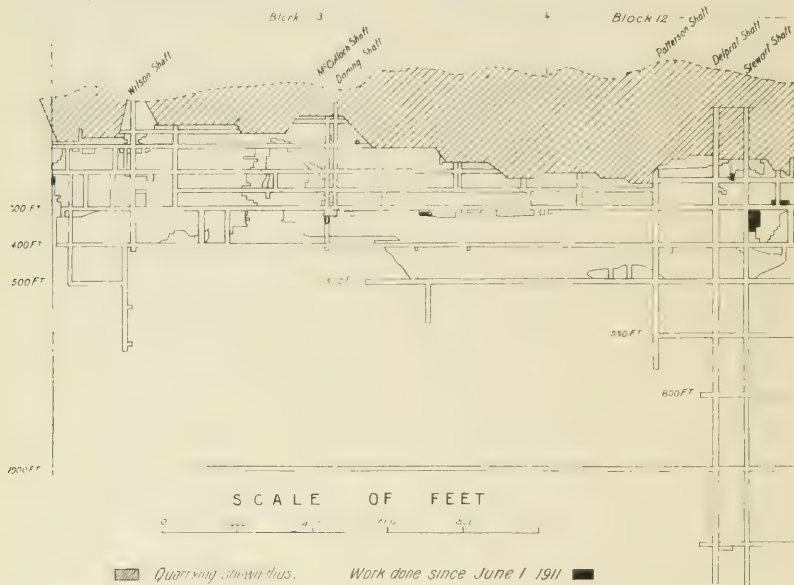
New Zealand Crown Mines.—This company was formed in 1895 by the Exploration Co. to acquire a gold-mining property at Karangahake, Hauraki, New Zealand. Dividends were paid from 1897 to 1903. The company was re-constructed in 1910, when the control passed to the Consolidated Gold Fields of New Zealand, which operates mines at Reefton. The Crown mines are adjacent to the Talisman. Since the re construction, John McCombie has been manager. The report for the year ended June 30 last shows that the issued capital was 302,661 shares of 4s. each, and that options are held on 159,756 shares. During this time the development has given improved results and the reserve is estimated at 78,545 tons. The mill treated 22,361 tons of ore estimated to contain 46s. 9d. per ton. The yield was 11,080 oz. gold and 7436 oz. silver, worth £47,282. The cost of mining was £22,466, of milling £9036, of development £6023, and of administration and realization of bullion £5600; the balance of profit was £3890, as compared with a loss of £1710 the previous year. Improved slime-plant is being installed.

Yuanmi Gold Mines.—This company was formed in April 1911, to acquire from what is now the Lake View & Oroya Exploration company, the Yuanmi mine situated in the East Murchison district of Western Australia. In the following November, an amalgamation was effected with the Oroya Black Range company. The latter company was formed in 1906 to acquire the Sandstone leases in the Black Range, East Murchison, and was an offshoot of the Oroya-Brownhill company, owning the mines at Kalgoorlie that were then showing signs of exhaustion. The results at Sandstone became disappointing in 1910, so a 50% interest in the Yuanmi property, situated 60 miles to the southwest, was acquired, the other 50% being taken by the Lake View & Oroya Exploration company. The Yuanmi was floated separately, as mentioned above, in April 1911, and the Oroya Black Range was absorbed again in the following November. H. C. Hoover is chairman of the Yuanmi company, James Brothers are the consulting engineers, and Bewick, Moreing & Co. are the general managers; H. G. Walton is manager at the Oroya Black Range, and A. Wauchope at Yuanmi. The report now issued covers the period from April 27, 1911 to June 30, 1912. At the Yuanmi mine 3824 ft. of development and shaft-sinking was done at a cost of £25,598, and on June 30 the reserve consisted of 57,922 tons of oxidized ore averaging 44s. 5d. per ton, and 39,354 tons of pyritic ore averaging 41s. 5d. per ton. The mill commenced work on March 1, and during the 4 months treated 18,332 tons of oxidized ore by all-sliming and cyaniding, the yield being 8704 oz., worth £36,949, averaging 40s. 4d. per ton. The revenue was £36,954, and the total expenditure on mining, milling, development, and equipment was £76,313, of which £42,219 spent on equipment was charged to capital account. The best method of treating the sulphide ore has not yet been determined. At the Oroya Black Range, the development has given fairly good results, the reserve on June 30 being 50,697 tons averaging 36s. 8d. During the period 41,890 tons was mined and sent to the mill, yielding by amalgamation and cyaniding 18,710 oz. gold, worth £79,497, or 37s. 11d. per ton.

The working cost was £53,759. After allowance for depreciation and administration expenses, the profit and loss account for the two mines shows a balance in hand of £853. The capital of the company is £350,000.

Broken Hill Proprietary.—The report for the half-year ended May 31 last shows that 111,285 tons of ore was raised, and 109,619 tons sent to the lead mill. The yield was 22,406 tons of lead concentrate, averaging 58·82% lead and 27·87 oz. silver, and 17,400 tons of slime, averaging 13·56% lead and 17·14 oz. silver. The re-grinding plant treated 111,733 tons of tailing, from which was produced 3512 tons of lead concentrate averaging 53·46% lead and 27·98 oz. silver,

bullion, and produced 37,513 tons of soft lead, 291 tons of antimonial lead, 1,823,539 oz. of silver, and 794 oz. of gold. In the zinc-distilling department, the roaster gave some trouble, and it was not possible to keep the whole of the zinc furnaces at work. Toward the end of the half-year, 6 of the furnaces were in employment. The output of zinc was 895 tons, and of blue powder 72 tons. The new scheme for establishing an iron and steel industry has already been noted in our columns. As regards the disposal of the lead produced at Port Pirie, it is reported that 21,155 tons went to Europe, 16,149 tons to India, China, and Japan, and 4893 tons to Australia and New Zealand. During the



SECTION OF THE BROKEN HILL

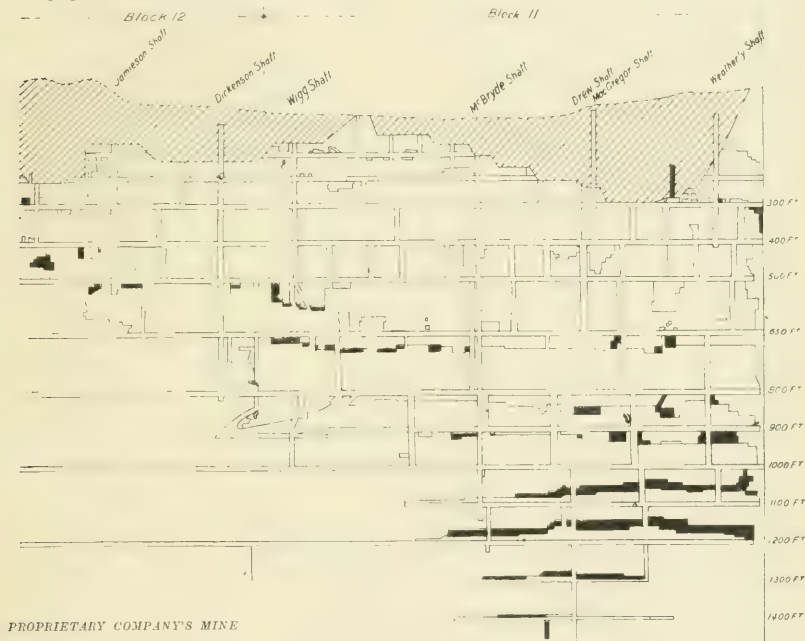
98,496 tons of zinc tailing assaying 16·55% zinc, 3·48% lead, and 6·07 oz. silver, and 9725 tons of slime assaying 19% zinc, 13·57% lead, and 17·14 oz. silver. The zinc-concentration plant treated 168,309 tons of zinc tailing, and produced 46,005 tons of zinc concentrate averaging 46·8% zinc, 6·87% lead, and 12·81 oz. silver. The slime-flotation plant treated 9455 tons for a yield of 3209 tons of concentrate, averaging 36·63% zinc, 20% lead, and 29·35 oz. silver. The exploration work at the mine was centred on the 1400-ft. level, and disclosed a continuation of the orebody with good average grade. At the smelter at Port Pirie, three lead furnaces were in commission, and treated 15,952 tons of oxidized ore, 62,006 tons of concentrate and slime, and 7924 tons of residues, flue-dust, and dross. Some of this material came from the company's mine and the remainder was bought. The production of bullion was 14,764 tons. The refinery dealt with 40,354 tons of

half-year, the sale of metals brought an income of £841,303, of which £240,038 was paid in the purchase of ores, and the profit was £186,883. The dividends absorbed £120,000. The total distribution since the commencement of operations in 1885 has been £9,536,000, on a capital of £384,000, and in addition, cash and shares amounting to £2,324,000 have been distributed on the flotation of the British, Block 10, and Block 14 companies.

British Broken Hill.—As we have already recorded, on several occasions recently, interest in this company owning a comparatively low-grade silver-lead-zinc mine at Broken Hill, has been revived by the discovery by drilling of a new lode that promised to add substantially to the resources of the company. Some difficulty has been experienced in estimating the content and value of the new orebody, and there has been much controversy on the subject between the manag-

ing director, W. H. Woodhead, and others. G. C. Klug, chief representative of Bewick, Moreing & Co. in Australia, has been appointed consulting engineer. The report now issued covers the half-year ended June 30, and it introduces a welcome innovation by including mine plans. During the half-year, 101,804 tons of sulphide ore and 302 tons of carbonate ore was raised; 101,390 tons of sulphide ore averaging 13.9% lead, 12% zinc, and 7.7 oz. silver, was sent to the concentrator, where 15,244 tons of lead concentrate was recovered, averaging 63.2% lead, 6.7% zinc, and 24.8 oz. silver. In addition, 51,514 tons of zinc tailing, averaging 14.3% zinc, 4% lead, and 3.9 oz. silver, and

by F. W. Baker and John Hays Hammond to acquire the gold mine in Ouray county, Colorado, from Thomas F. Walsh. After yielding handsome profits for ten years, the mine showed signs of exhaustion, so another property was acquired, the Santa Gertrudis silver mine at Pachuca, Mexico. The purchase was effected by means of the cash reserve and by the issue of debentures; the Santa Gertrudis was floated as a separate company, and practically the whole of the shares in it were subscribed by the Camp Bird. During the year ended June 30 last, 52,447 tons of ore was broken, and 68,394 tons sent to the mill. The reserve of broken ore in the stopes was reduced to 1535 tons. The yield



PROPRIETARY COMPANY'S MINE

19,846 tons of slime were produced. The former was sent to the Elmore plant for treatment, and the latter delivered to the Junction North company. The Elmore plant produced 14,651 tons of zinc concentrate, averaging 40.5% zinc, 11% lead, and 11 oz. silver. The income from the sale of concentrate, slime, and carbonate ore was £202,279, and the net profit, after the payment of £888 debenture interest, was £62,067. Out of this, £60,000 has been paid as dividend on the 300,000 shares. Since the close of the half-year, 60,000 new shares have been issued at 30s. each, for the purpose of providing capital required for mining the new orebody. Mr. Woodhead's report on the developments on the new orebody does not appear to confirm the results of the boring, for a large part of it exposed in the drifts and cross-cuts is of low grade.

Camp Bird.—As we have recorded on previous occasions, this company was floated in London in 1900

was worth \$1,742,040, or \$26.15 per ton. The working cost was \$7.81 per ton. The remaining reserve of unbroken ore was calculated to provide a profit of \$100,000, while another \$100,000 may be reckoned as possible profit. The rate of production of ore remained normal until the end of 1911, and since then the delivery declined until it is now only 50 tons per day. The net profit for the year was \$1,134,006, or £223,159. The receipts from the Santa Gertrudis shareholding amounted to £157,648, and the total profit was £376,399, out of which £20,713 was paid as debenture interest, £35,225 as preferential dividend, and £220,010 as dividend on the ordinary shares, being at the rate of 20%. During the year, the debentures were retired and preference shares issued instead, the capital thus standing at 1,100,051 ordinary shares of £1 each, and 750,000 preference shares of similar denomination. During the life of the company, 702,209

tons of ore has yielded gold worth £4,115,666, and the shareholders have received £1,725,012 in dividends. Now that the mine is rapidly approaching its end, the board has considered the advisability of securing other properties, and is negotiating, together with other parties, for a mine in Mexico. It will be remembered that the company is interested in the Messina mine in the Transvaal, having guaranteed interest on its debentures in consideration for a call on shares. It is intended to continue the life of the Camp Bird company by transforming it into what may be conveniently called a mining investment trust.

Santa Gertrudis.—As recorded in the previous paragraph, this company was formed by the Camp Bird company in January 1909, to acquire a silver mine at Pachuca, Mexico. The report for the year ended June 30 shows that the new mill, with a capacity of 660 short tons per day, started work on June 14, 1911. During the year under review, the two mills treated 269,839 tons of ore and tailing, having an average assay-value of 52s. 11d. per ton. From this 26,006 oz. gold and 4,420,326 oz. silver were extracted, being a recovery of 46s. 10d. per ton. The sale of this brought an income of £631,432, and the working cost was £355,934. After allowing for depreciation, the net profit was £252,421; out of this, £21,745 was written off for preliminary expenses, and there were also London expenses and taxes to pay. The sum of £207,200 was distributed as dividend, being at the rate of 15% on £1,368,000. In June the old mill was finally closed, and it is expected that the addition to the new mill, bringing its capacity to 850 tons per day, will be in working order before the end of 1912. During the year, 16,249 ft. of development was done. The reserve is estimated at 586,000 tons of positive and partly developed ore, and 551,000 tons of probable ore, calculated to yield a profit of \$7,475,000. A year ago the figures were 630,000 tons, 520,000 tons, and \$8,175,000 respectively. W. J. Cox is advisory engineer, and Hugh Rose manager.

Palmarejo & Mexican Goldfields.—This company was originally formed in 1886 to acquire gold-silver mines in the western part of the state of Chihuahua, Mexico. We have often recorded the series of vicissitudes through which it has passed. In 1908 the control changed hands once more, and E. T. McCarthy was asked to examine and report. The results of his investigations and the new financial proposals were recorded in this column in our issue of July 1910. The report for the year ended June 30 last shows that the series of revolutions in Mexico have interfered with the delivery of the new machinery recommended by Mr. McCarthy. Some has arrived on the spot and the rest is stranded between the railway and the mill. During the year under review, the development has been actively continued, 5020 ft. being done. The reserve consists of 318,849 tons of positive ore averaging 2 dwt. gold and 13 oz. silver, 255,438 tons of probable ore, and 1,425,713 tons of possible ore. On May 15 last, the conditions in the district were such that it was found necessary to suspend operations, and the staff retired from the country, leaving two behind as caretakers.

Oroya Leonesa.—This company was formed in 1910 to acquire from the Oroya-Brownhill the Leonesa gold mine, situated at Matagalpa, Nicaragua. It belongs to the Lake View & Oroya Exploration group. H. C. Hoover is chairman, and James Brothers are the consulting engineers. The management was in the hands of Bewick, Moreing & Co. until last March, and on the expiry of their agreement, F. W. Nobs was appointed manager. The report for the year ended

March 31 last shows that the working capital has been exhausted, and that a loan secured by the issue of £35,000 debentures has been obtained from the Lake View & Oroya Exploration company. The mill consisting of 20 stamps was put into commission in August of this year, and the yield has averaged 30s. per ton, at a working cost of 22s. 4d. per ton. Owing to shortness of funds, no development has been done. The ore reserve on March 31, 1911, was estimated at 94,358 tons, averaging 39s. 9d. per ton. Revolutions and labour difficulties have greatly interfered with mining operations and with the transport of machinery and supplies. The issued capital of the company is £225,003.

Tolima.—This company was formed in 1871 to acquire the Frias silver-lead mine in Tolima, Colombia, and in early days large profits were made. Later, in 1903 and 1909, it became necessary to re-construct and provide further funds. Last year we were able to report that the mine had once more been placed on a profitable basis, and the report for the year ended June 30 last shows that the improvement has continued, and that not only have the debentures been retired but dividends paid to the shareholders. The amount of ore raised was 15,645 tons, from which 1291 tons of concentrate was produced, estimated to contain 649,844 oz. silver, or 505 oz. per ton. The amount of concentrate shipped abroad during the year was 1280 tons. The sum of £73,116 appears in the mining account as credit for ore shipped, and against this is an item of £16,445 for freight and smelters' charges. The profit for the year was £19,132, out of which £10,208 was devoted to the redemption of the debentures, and £5000 distributed as dividend, being at the rate of 5%. Developments have been encouraging, and the ore reserve is sufficient to keep the mill going for nearly two years. The increased funds in hand will make it possible to press development work. The directors are contemplating the purchase of a neighbouring gold-silver property.

Aramayo Francke Mines.—This company was formed in 1906 to acquire the tin, wolfram, and bismuth mines in Bolivia, belonging to Aramayo, Francke & Co. In 1908 additional mines were acquired at Chorolque. The consolidated properties now consist of mines at Chorolque, Tasna, and Chocaya, with a smelter at Quechisla, and a number of concentrating plants, the most modern of which, the Sala-Sala, was described in our issue of March 1911. The district in which the properties are situated is the southern part of Bolivia, between Potosi and Tupiza. The issued capital of the company is £596,590, and there are £80,000 debentures. The report for the year ended June 30 last shows a profit of £155,966 as compared with £103,194 the previous year. Out of the profit, £3536 was paid as income tax and £5100 as debenture interest; £31,000 was devoted to the redemption of debentures, and £119,318 was paid as dividend, being at the rate of 20%. The sale of tin concentrate amounted to 4053 metric tons, which sold for £355,515, and of wolfram concentrate 52 tons bringing £11,625. Figures for the production of bismuth are not given. The alteration in the nature of the ore worked during the last few years is noteworthy. Originally the tin ore from the outcrops was rich, and ore containing 6% was thrown on the dump. Owing to the exhaustion of the surface ores, it has been necessary to provide modern concentrating plant for the treatment of the lower-grade ores, and much money has been spent with this object in view. In 1909 the tonnage of ore treated was 17,522, averaging no less than 19% cassiterite; in 1910, the tonnage was 25,882, averaging 14½%; in 1911, the

figures were 36,903 tons averaging 10½% ; and during 1912 up to date, 41,436 tons has been milled averaging 9.9%. The Santa Barbara dumps averaging 6% have been exhausted, and other dumps averaging 3% are now to be treated. Hydro-electric plants are being supplied for power and drilling purposes; owing to the high altitude at Chorolque, 14,000 to 16,000 ft. above the sea, the use of compressed air is avoided. A smelter has been erected at Quechisla for the purpose of producing copper matte; this is expected to be in commission shortly.

Naraguta (Nigeria) Tin Mines.—This company was formed in January 1910, to acquire the Naraguta alluvial tin property, 5 square miles in extent, in the province of Bauchi, Northern Nigeria. F. N. Best is chairman, C. G. Lush is consulting engineer, and F. O'D. Bourke is manager. The report now issued covers the year ended March 31 last. During this period, 560 tons of tin concentrate was recovered, by ground-sluicing, calabashing, and tributing, as compared with 551 tons during the previous period, which consisted of 14 months. The net proceeds after the payment of freight was £55,583, and the profit was £30,660. The sum of £35,000 has been distributed as dividend, being at the rate of 20%. Mr. Bourke reports that the tested ground will provide work at the present rate for 20 years, and that the recoverable amount of black tin is 10,000 tons. New properties are being acquired in the Ninkada district, where prospecting has disclosed 1500 tons of black tin.

Jibutli Mines of Anantapur.—This company was formed by John Taylor & Sons in June, 1911, to purchase from the Nundydroog company the Jibutli gold-mining property at Anantapur, Madras, 3 miles long by 1 mile wide. Sufficient work had been done to prove the great extent of the orebodies. The capital of the company is £220,000 in shares of 10s. each; 280,000 shares went to the Nundydroog company as purchase price, together with £8000 cash, and 133,146 shares were subscribed on which 8s. has been paid. Development has been actively pushed, with satisfactory results, and 20 stamps, a tube-mill, winding and pumping plant, etc., have been ordered. Further capital is needed, and 50,000 preference shares of 10s. each are to be issued.

Goss Moor Tin Alluvials.—This company was formed in 1909 to acquire from T. L. Field and C. G. Lush an alluvial tin property on Goss moor, between St. Austell and Newquay, Cornwall. It was reconstructed in May 1911. J. H. Collins and Oliver Wethered are on the board, and C. G. Lush is managing director. An account of the method of working was given in our issue of July last. The alluvium is broken down by hydraulicicking, and raised by a pump to a floating barge containing the sluice-boxes, this being a usual Australian practice. The report for the period May 1, 1911, to August 31, 1912, shows that the new steam plant substituted for a suction gas plant commenced operations on August 15 last year, and during the 12½ months treated 193,620 cu. yd. of gravel. The recovery was 60½ tons of tin concentrate assaying 73% metal, and selling for £7561. The cost of operations and administration was £9642, so that the loss was £2081. The results are disappointing, and various suggestions as to the future have been made. One is to form a subsidiary company to treat part of the property on the northern side of the Far and Newquay railway by a bucket-dredge. It is intended also to change the power again, this time to electricity, to be supplied by the local power company; it will thus be possible to use 5 or 6 small installations of barges, pumps, and monitors, instead of

a single large one as at present. The present cost per yard works out at 12d., which is double Mr. Lush's estimate, and compares with 5d., the figure quoted by him in connection with a property in Australia. We would draw the attention of our readers to a paragraph in the Camborne correspondence, on another page, analysing the results.

Asgard.—This company owns the Mount Roudny gold mine at Zwetow, Bohemia. The property was originally introduced in England in 1903, when it was acquired by the Mount Roudny Gold Mines, but in 1909 the debenture holders foreclosed and their trustee sold it. The capital of the present company is £20,000, and dividends have been paid since its formation. The report for the year ended June 30 last shows that 29,820 tons of ore was milled, yielding 5919 oz. gold by amalgamation, 1911 oz. in concentrate, and 249 oz. by cyanidation of tailing, a total of 8075 oz., worth, with silver and sulphur, £35,038, or 23s. 6d. per ton. The total expenses were £28,479, and the disposable balance was £6998, making, with the balance brought forward from the previous year, £12,258. The dividends absorbed £10,000, and £500 was written off the preliminary expenses account. J. Hoffmann, the manager, reports that 6000 ft. of development work has been done during the year, and that the ore reserve now stands at 132,453 tons, averaging 8 dwt. per ton. The outlook is therefore decidedly encouraging.

Simmer & Jack.—This company was formed in 1887 to acquire property in the eastern part of the Central Rand, and has been producing since 1888. The mine has always been the most important asset of the Consolidated Gold Fields group. There are 320 stamps and 7 tube-mills. During the year ended June 30 last, 922,624 tons of ore was mined, and after the removal of 7% waste, 863,500 tons was sent to the mill, where by amalgamation and cyaniding, 246,771 oz. gold was recovered, worth £1,036,585. This was an extraction of 5.7 dwt., or 24s. 1d. per ton milled. The working cost was £511,521, or 11s. 10d. per ton, leaving a working profit of £529,944, or 12s. 3d. per ton. The dividends absorbed £450,000, being at the rate of 15%. The ore reserve on June 30 was estimated at 2,680,000 tons, averaging 6.2 dwt. per ton, together with 438,000 tons of partly developed ore, averaging 5.3 dwt. In addition there is a considerable tonnage available for stoping in the upper levels, and in the foot-wall and hanging wall. The system of sand-filling is being extended. According to the table given in last month's précis of technology, the prospective life of the mine based on claim area is 12 years.

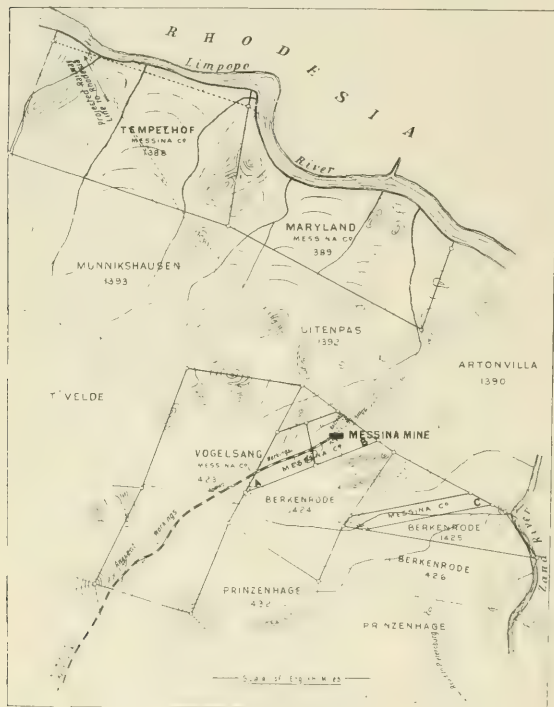
Sub-Nigel.—This company was formed in 1895 to acquire a gold-mining property in the Heidelberg district of the Transvaal. The position of the mine is shown in the map appearing on page 391 of our November issue. In 1909 the Nigel Deep company was absorbed, the latter having been a producer since 1899, but not a dividend-payer. Both companies belonged to the Consolidated Gold Fields group. The report for the year ended June 30, shows that 80,671 tons of ore was mined, and, after the rejection of 27% waste, 52,328 tons was sent to the mill, which contains 30 stamps and 1 tube-mill. The recovery by amalgamation and cyaniding was 22,639 oz., valued at £94,735, being 8.65 dwt. or 36s. 2d. per ton milled. The working profit was £3828 or 1s. 5d. per ton. C. F. Parry, the manager, reports that during the year 5269 ft. of development work was done, and that much trouble is experienced owing to dikes and faults. The ore reserve is consequently difficult to estimate; the figures given are 85,000 tons, averaging 8.9 dwt., together with 25,000 of partly developed ore, averaging 9.7 dwt.

Messina (Transvaal) Development.—This company was formed at the beginning of 1905 to acquire a copper property consisting of ancient mine-workings in the north of the Transvaal near the Rhodesian border, 130 miles from Pietersburg. A. M. Grenfell is chairman, and R. J. Frecheville is on the board; J. M. Calderwood is consulting engineer, and J. Allan Woodburn is manager. We have in previous years given an outline of the earlier operations. The deposit is rich, but progress has been hampered by the absence of communication with the outside world. Much high-class ore has been mined, chiefly in de-

equal to 4½% on the estimated expenditure of £426,831. Connection with Delagoa Bay, through the Selati railway, will no doubt come within a few years' time. The report for the year ended June 30 last shows that 6781 ft. of development work was done at a cost of £21,928. Of this, about 2500 ft. was on the lodes, and the part sampled, 1533 ft., gave an average assay-value of 13·1% copper over an average width of 60 in. The content is so far fully maintained down to the lowest workings, and the value of the Bonanza ore-body increases steadily from the 4th to the 8th level. The copper minerals are chiefly bornite and chalcop-

pyrite, occurring in massive form. The report contains full details of the ore reserve together with plan and sections through the lodes. The ore reserve is calculated at 170,000 tons averaging 10% copper, and in addition, the probable ore is estimated at 200,000 tons. During the year, 9609 tons of development ore was raised, averaging 9% copper, and 10,347 tons milled; 1162 tons of concentrate was recovered averaging 49·8% copper, together with 836 tons of middling averaging 14·2 copper to be re-treated later. The tailing and slime are being stored. The amount of concentrate shipped was 1119 tons, and it was sold for £29,761. The cost of mining and milling was £15,868, shipping charges were £6003, Johannesburg expenses £4610, London expenses £6472, development-redemption £2586, allowance for depreciation £2697, and with other small items an adverse balance was left of £4674. Debenture interest was £5181, and expenses in connection with the issue were £809, so that the final debit balance carried to the balance sheet was £10,666. The new concentrating plant now being built is designed to treat 10,000 tons of ore per month, and further additions are to be made so as to bring the figure to 12,000 tons. In his speech, the chairman reported that the development recently done on adjoining ancient workings is giving most promising results.

Falcon Mines.—This company was formed in February 1910, to acquire from the Rhodesia Consolidated company, the Falcon group of gold-copper mines situated 60 miles west of Gwelo, Rhodesia. Recently the control has been transferred to the Consolidated Gold Fields group. H. A. Piper and A. J. Fraser are the engineers. The report for the year ended June 30 shows that development has been actively pushed, 5937 ft. having been done, and that the reserve on the date mentioned was 730,000 tons, of which 311,168 tons was developed during the year. The larger part of this is sulphide ore, and the average content is about 5 dwg. gold and 3% copper. The 6th or lowest

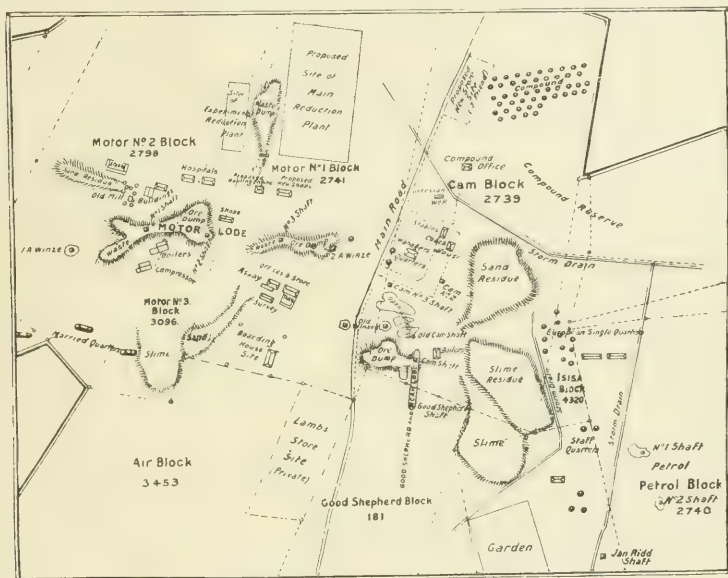


Plan of Messina Property.

velopment, and sent to Swansea, but at a prohibitive cost for transport. Before long the mine will be provided with railway facilities, for lines are being built both from Delagoa Bay and Pretoria, to connect eventually with the Rhodesia railway system. At the present time the Pretoria railway is being extended from Bandler Kop, the present northerly terminus, to Messina, a distance of about 100 miles, and the work should be completed by the middle of next year or rather later. The railway is being built by the Government, and the company guarantees for 10 years to make good any loss on the working of the line, the amount payable in any one year not to exceed a sum

level contains ore of higher content than those above, and the orebody shows no sign on that level of diminution in thickness or length. A plant to treat 500 tons per day is being erected, and should be ready in a year's time. The plan is to reduce the silica content by concentration and then smelt. A recovery of 90% of the copper and 80% of the gold is anticipated. An iron mine has been acquired for the supply of flux, and limestone is obtainable near-by. A new vertical main shaft is being sunk, to cut the orebody at 860 ft. vertical, or 1000 ft. on the incline. This is being lined with steel sets.

Giant Mines of Rhodesia.—This company belongs to the Weil group, and was formed in 1903 to acquire from the Enterprise company the Giant gold mine situated 65 miles west of Salisbury, Rhodesia. Dividends have been paid regularly since 1906, and the present plant contains 30 stamps and 2 tube-mills. The report for the year ended June 30 last, shows that the borings undertaken, under the direction of G. S. Corstorphine, with a view of finding the lode, which is faulted below the 7th level, have not yet given any satisfactory result, and that in consequence the ore reserve has not been maintained, the figures being



THE CAM & MOTOR COMPANY'S PROPERTY.

Cam & Motor.—This company belongs to the Weil group and was formed in 1910 for the purpose of acquiring gold mines in the neighbourhood of Gatooma, Rhodesia. The Good Shepherd property adjoining was purchased subsequently. The report now published, covering the year ended June 30 last, and containing information up to October 18, shows that development has been actively pushed with satisfactory results, for on the latter date the reserve stood at 904,408 tons, averaging 45s. per ton, as compared with 607,664 tons of similar grade a year ago. The work has been confined to the Motor mine, which contains 90% of the reserve. The lowest or 5th level is in as good ore as those above. Lengthy trials have been made in connection with the treatment of the ore, which, as is often the case in Rhodesia, contains arsenic and antimony, and a plant to treat 15,000 tons per month has been ordered. The process consists of dry ball-milling, roasting in Edwards furnaces, fine grinding in tube-mills, leaching the sand, and vacuum filtration for the slime. The plant should be in operation in a year's time.

243,687 tons as compared with 308,146 tons a year ago. During the year, 134,209 tons was raised from the mine, and yielded 52,116 oz. gold worth £221,405. The working profit was £128,337, out of which £7755 has been spent on boring operations, and £20,000 added to the reserve fund, which now stands at £70,000. The dividends distributed during the year totalled £98,720, being 40% on the issued capital. Since the commencement of operations in 1905, the tonnage milled has been 537,320, the yield £870,688, and the distribution as dividend £308,715.

Gaika.—This company was formed in 1902 by the Rhodesian Exploration & Development Co. to acquire a gold-mining property near Que Que, Rhodesia, not far from the Globe & Phoenix. During the past year the control has passed to the Consolidated Gold Fields group. Milling commenced in 1905, and the plant contains 5 stamps, 1 Huntingdon mill, and 1 Chilean mill. The first dividend was paid a year ago, when 5% was distributed on the 273,495 shares of £1 each. During the year ended June 30, the amount of ore milled was 34,243 tons, yielding by amalgamation and

cyaniding 14,636 oz. gold, worth £61,522. The mining and milling cost was £33,277, allowance for depreciation £3998, London expenses £1419, and development £10,601, leaving a profit of £13,921, out of which £13,674 was distributed as dividend, being at the rate of 5%. During the year 3000 new shares were issued for the object of purchasing the Robin Hood mine, and 10,000 shares were issued at 42s. 6d. (being at a premium of 22s. 6d.) to provide the additional capital required for extending the metallurgical plant and for supplying electric power; £19,629 was spent in this way during the year under review. Development has been actively pushed, with the result that the reserve has been increased from 30,959 tons averaging 15'4 dwt., to 57,755 tons averaging 15'1 dwt. H. A. Piper and A. J. Fraser are the engineers.

Lena Goldfields.—This company was formed in 1908 to acquire a majority interest in the Lenskoie Co., a Russian venture operating unusually rich auriferous gravel deposits in the valleys adjoining the Vitim river, a tributary of the Lena, in Eastern Siberia. The report now issued covers the year ended September 30, and it shows that the late labour troubles have not only caused a decrease in the current year's output, but have rendered necessary the postponement of the payment of the dividend earned by the Russian company during the year ended October 1911. The directors properly refer to the unusually sad episodes in connection with the recent strikes, and express their regret that the circumstances under which they hold a majority of the shares in the Russian company should give them no say in the management or control of the operations. During the year ended October 1911, the production of gold was 430,839 oz. worth £1,619,410, from 861,438 cubic yards, and the cost as declared by the Lenskoie was £1,089,447. Out of the profit, £156,321 was allowed for amortization, £106,703 was paid as taxes, and £271,111 was distributed as dividend. The English company received £180,048 of this dividend, and in addition, received £31,122 as interest on money lent to the Lenskoie. The sum of £30,000 was brought into profit and loss account from reserve, making with the balance from last year a disposable balance of £236,511. Out of this, £224,701 has been declared as dividend, being at the rate of 20%. But as the remittance of the Lenskoie dividend has not been received, it will not be possible for the Lena company to distribute its dividend until next midsummer. During the year, the company subscribed for 24,193 new shares in the Lenskoie, costing £719,333. C. M. Rolker, the consulting engineer, reports that the yield for the year ended October 1912 was 260,505 oz. worth £979,169, the drop as compared with last year being due to the labour troubles.

Oriental Consolidated.—This is an American company, formed in 1897 to acquire a gold-mining concession in northwestern Korea, otherwise Chosen, as it is called nowadays. H. C. Perkins is president, and the Mills and Haggin groups have large holdings. The principal mines are the Tabowie and the Taracol, and other producers are the Kuk San Dong, Maibong, Candlestick, Chintui, and Charabowie. There are 5 separate mills containing altogether 240 stamps, and each is equipped with a concentrator and cyanide plant. During the past year a new tube-mill plant has been erected for the treatment of concentrate. This was designed by A. E. Drucker, the metallurgist. The report now issued covers the year ended June 30. It shows that 323,703 tons of ore averaging \$5'86 per ton was raised, 121,420 coming from the Tabowie and 126,755 tons from the Taracol. The yield by amalgamation was \$939,390, and from the concentrate

\$600,817, making a total production of \$1,540,207, or \$4'76 per ton milled. The working cost was \$864,490, and \$45,092 was spent on new plant and development. The profit for the year was \$652,526, and \$429,390 was distributed as dividend, being at the rate of 10%. As regards ore reserves, Alfred Welhaven, the manager, reports that on July 1 the total was 741,000 tons, averaging \$5'2 per ton. The development at all the mines has been satisfactory during the year, with the exception of Kuk San Dong, which shows signs of exhaustion.

Middleburg Steam Coal & Coke.—This company was originally formed under Colonial law in 1902 (subsequently to be registered in England in 1906), for the purpose of acquiring a coal property at Witbank, in the Middleburg district of the Transvaal. The coal seam is 15 ft. in thickness. The report for the year ended June 30 shows that 263,140 tons of coal was raised, being an increase of 35,200 tons over the previous year, and but for the poor facilities provided by the South African Railways, the output would have been greater. The development of the mine is kept well ahead. The operating profit was £20,970, and after the payment of royalties and expenses of administration, £17,048 was available for distribution. Out of this, £797 was paid as interest on the 6% debentures, £3245 as dividend on the 5% preference shares, and £4722 as dividend on the ordinary shares, being at the rate of 5%; £2500 was transferred to the reserve fund, which now stands at £7500, and the remainder was carried forward. The company has devoted attention recently to oil-shale at Mooifontein, Ermelo, and the property has been transferred to a new company called the Transvaal Oil Shale Syndicate. Among other assets is a gold-mining property in the Lydenburg district; this is held through a subsidiary company, the Transvaal Gold Trust. Developments at this property have resulted in the proving of 21,800 tons of ore, and treatment plant is in the course of erection.

TRADE NOTES

Most of the trade publications mentioned in this column are available for distribution and the manager of The Mining Magazine will be pleased to secure copies for persons interested.

The International Concentrator Co. announce their dry concentrator in a 30-page booklet.

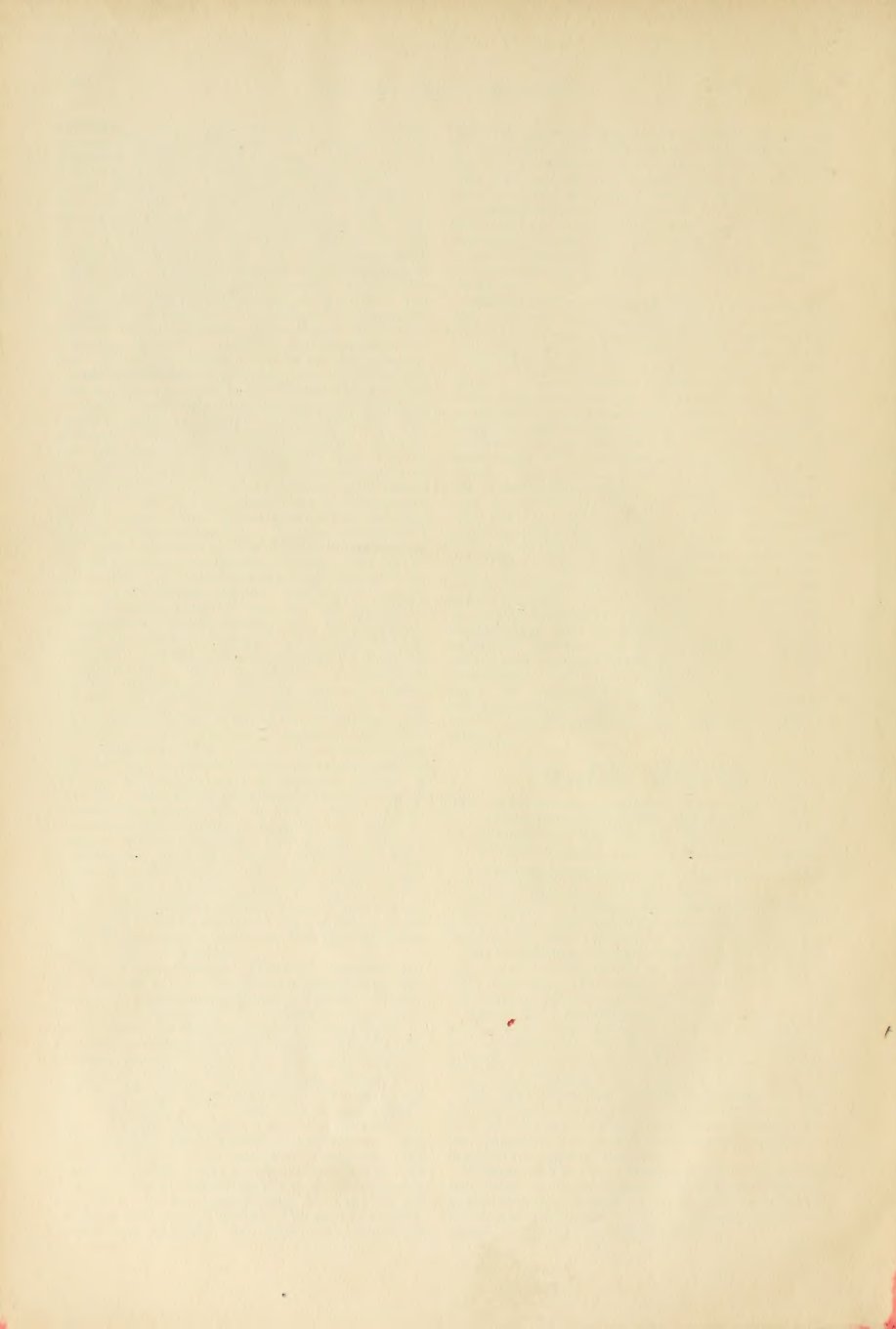
The Hinman Hydraulic Manufacturing Co. make a speciality of canal and reservoir appliances and have issued an attractive catalogue giving full particulars.

Pile Hammers for light and heavy duty are described in a recent bulletin sent out by the McKiernan-Terry Drill Company. The smaller machines are particularly adapted for driving sheet-piling.

Boving & Co. announce that their staff and directorate has been greatly strengthened by the addition of Mr. James Walker, who has had long and extensive experience in engineering work by his former association with S. Pearson & Son and J. G. White & Co.

The Ridge Roasting Furnace & Engineering Co. has been formed to acquire the interests of Mr. H. M. Ridge in roasting, calcining, and drying furnaces, including applications for new patents covering improvements in this class of machinery.

Gillespie & Co., of 2 Whittington Avenue, Leadenhall Street, agents for Cameron Mine Pumps, remind us that they keep a stock of pumps and spares ready for immediate shipment. This company also act as agents for the Star-Drilling Machine Co.



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